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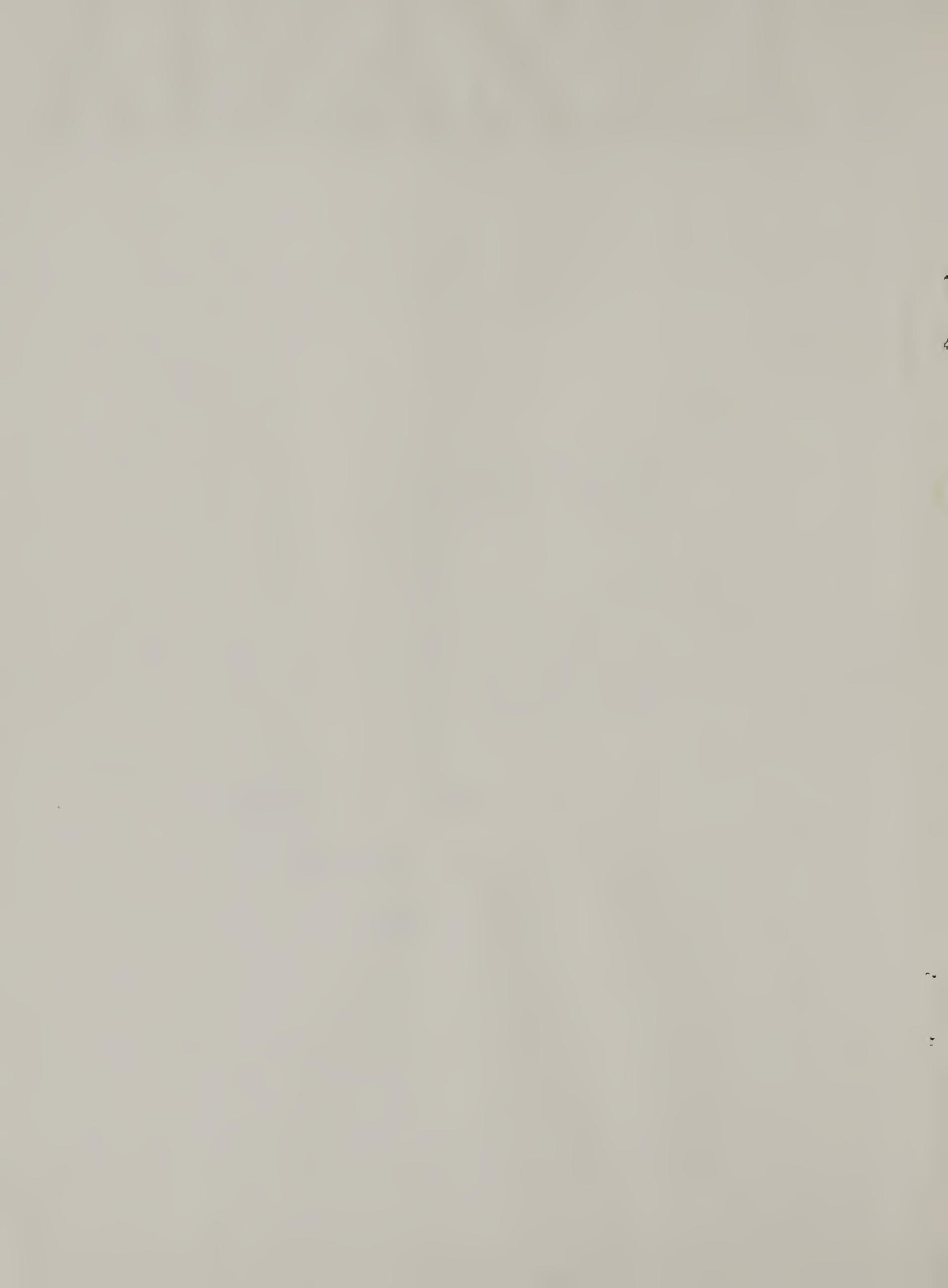
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RANGE AND LIVESTOCK IMPROVEMENT IN MASAILAND
TANZANIA

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Introduction

BACKGROUND

Through the Agency for International Development (AID), the Minister of Agriculture of Tanzania requested a five-man team to make a detailed study of one ranching association in the Masai District and prepare a livestock and range management program for this District which could also be used as a model for extending improved practices and production throughout the Masai District.

Tanzania's economy depends heavily upon agriculture. Nearly half of its 364,900 square miles -- 155,000 -- are utilized for livestock grazing. It has a large livestock population of approximately 12 million cattle and 6.52 million sheep and goats. The production of meat from this livestock population is relatively low and Tanzania needs more meat for local consumption and for canned meat export. The nomadic Masai can exist in this dry part of the country because they are able to manage cattle. These people have also developed rigid cultural customs which often carry high risks to the population if not adhered to.

In 1964 the Tanzanian Parliament passed the Range Development Act which was to provide the legal basis for increasing livestock production and improving land use on the 155,000 square miles of grazing land in Tanzania. In the same year the first range development area was established in Masailand and Komolonik - covering 220,000 acres near Monduli - was chosen for the pilot demonstration ranching association. The Masai Range Commission constructed and financed physical improvements on this land, but the association has not been registered yet because the Masai refuse to accept the budget for these improvements or the stock quotas presented by the Commission. The team was asked to evaluate this situation.

The study was made between September 1968 and January 1969. The team was composed of Team Leader Robert J. Deans, Livestock Economist, Federal Extension Service; Clyde M. Teague, Range Management Specialist, Farmers Home Administration; Lloyd G. Signell, Agricultural Engineer, International Agricultural Development Service; Bruce M. John, Sociologist, Federal Extension Service; and Melvin E. Knickerbocker, Agronomist, Federal Extension Service.

TEAM ASSIGNMENT

1. The first priority was to prepare a detailed development plan for the Komolonik Ranching Association and evaluate the concept of a model association being developed.

The following were the specific objectives for the Komolonik phase:

a. To plan range, water and livestock development, improvements to increase livestock production and arrest the soil erosion and destruction of the range resources.

b. To stabilize the livestock industry, improve land tenure, settle the nomadic Masai, and provide greater incentive to increase production.

c. To improve the livestock producer's animal husbandry/management and range management capabilities, and increase the output of beef per acre and per man effort.

d. To improve services to the livestock producers including credit, availability of production supplies, marketing and technical assistance.

e. To train the livestock producers in more effective management of inputs and outputs.

f. To encourage and teach the livestock producers to cooperate to reduce production and marketing costs.

g. To reduce the extremely heavy animal loss through control of diseases and parasites, improve animal quality and shorten the growing-maturity period through upgrading, and increase off-take through regularized marketing.

h. To study the cultural and social customs, values and traditions to determine the factors which inhibit development and how to cope with them.

2. Study proposals for three additional ranching associations that have been identified (Olmoti, Kijungu and Loliondo), consider their size and limiting factors, and assist in the preliminary preparation of organizational and development plans for future implementation.

3. Identify, locate, and delineate geographically additional areas in the balance of the Masai District that will warrant development as ranching associations or private ranches when resources become available.

MAJOR PROBLEM AREAS

SITUATION - MASAILAND

The following presents the team's evaluation of the major problems in livestock range development in Masai District, especially with regard to the Ranching Association development concept.

Association Registration - Komolonik

Intensive capital investments have been made at Monduli on the proposed Komolonik Ranching Association area with relatively little being asked of the Masai there, either in contribution or in their participation in planning. This has been a relatively rapid, extensive, complex, government-directed and implemented effort with the sincere intent that it form a model for ranching association development. Unfortunately, it has not resulted in the hoped-for willingness on the part of the potential membership to accept the conditions for registration.

Association Formation - New Areas

Masai in other areas of Masailand, faced with problems similar to those in the Komolonik area, have indicated to Government the desire to form an association and obtain government assistance. However, little action has been taken outside the Komolonik area due to some extent to the intensive efforts of the Range Commission personnel to register the Komolonik Association.

The range act and regulations are complex. A document "A Guide to the Use of the Range Development and Management Act," 1965, was prepared by the UNDP* survey team. This interprets intent and requirements but, being an interpretive document, leaves some flexibility as to requirements. Those interested in forming new associations are aware that they must do so by accepting certain of the provisions of the act but are concerned about just what they can and ought to be expected to do during the formative periods. Thus the issue becomes one of choosing between alternative approaches.

* United Nations Development Program

Range Commission Organization and Function

Communication between the range commission, its technical sub-committee, and the Masai "members" of the association is poor, and division of responsibility within the commission personnel is not clear. This adversely affects the confidence the Masai membership has in the Range Commission and the technical subcommittee.

Marketing

The livestock marketing system in Masailand is inefficient with low, erratic prices and a poor market infrastructure resulting in heavy shrinks and losses and a strong illegal market. This is complicated by dissent within the Ministry as to who has final authority. Poor marketing is a major obstacle to any improvement in the livestock industry.

Demonstration Concept

The demonstration concept of introducing change is valid but the "Demonstration Ranch Unit" at Ardai plains is not effective in this regard. The demonstration unit does not present an environment similar to that of the villages, or bomas, of the Masai. Consequently, it will be difficult for the people to relate improved procedures to the life of the boma.

Recommendations

ORGANIZATION OF RANGE DEVELOPMENT

1. The Range Act is complex and should be simplified or given maximum flexibility in its interpretation.
2. Communication between the Range Commission and the Masai must be improved. Commission members should increase field contact with Masai and minimize meeting only at Monduli.
3. The division of responsibility between the Commission Secretary and the Technical Officer should be more clearly defined.
4. Consistency must be obtained in the philosophy and commitment arrangements made between various Commission personnel and Masai.
5. The technical sub committee should not be involved in non-technical matters.
6. GOT should consider forming a technical section of the Commission with Masai representation.
7. The activities of the Ministry of Agriculture and the Ministry of Land Survey and Water Development must be coordinated in the development of Masai District. Particular emphasis must be placed on coordinating improvements in areas adjacent to proposed association areas.
8. GOT should resolve the question of district council authority and responsibility in association areas emphasizing association autonomy and flexibility of action.

COMMUNICATIONS

1. Identify the varying decision making localities in Masai District and maintain regular, frequent field contact at these points with Masai councils.
2. Do not split localities in designing programs.
3. Favor Masai determining their problem areas and start with simple, easy-to-complete, low-cost, low-risk projects.

4. Consider the age-sets by working with cooperative alternative age-set groups, particularly with the leaders.

KOMOLONIK ASSOCIATION

1. Alternative budgets are presented to illustrate cost of operation if self-supporting and also to provide budget with government subsidizing.
2. If initial cash requirements are too high for Masai, minimum support should include:
 - a. costs of operation and depreciation of functioning dips,
 - b. water system maintenance,
 - c. vaccination,
 - d. management (when available).
3. Stock quota scheme is presented to provide initial expansion for members with few livestock units.
4. Much improved communication needed between Commission personnel and association membership.
5. Masai must be involved to a greater degree in the planning of association matters.
6. Masai must be held to their commitments once they have made a clear agreement.

WATER DEVELOPMENT

1. Twelve additional water resource sites are identified for maximum range utilization and conservation (Page 85).
2. A standard design for a facility for watering small stock should be developed and demonstrated.
3. Water supplies for prolonged drought periods must be provided and two points are identified for construction of deep drop-inlet type dams (page 80).
4. Consideration must be given by Ministry of LS and WD to water resource development outside the perimeter of association areas to avoid trespassing and subsequent range deterioration.

5. Water-point-use should be regulated to control grazing.
6. Water points in Komolonik are set at three mile radii of travel with consumption rate calculated at five gallons (Imperial) per livestock unit.
7. Operation and maintenance of water resources should be the responsibility of ranching associations. Servicing, repair and technical guidance should be obtained at the proposed central repair shop at Arusha. Charges should be borne by the association.

RANGE MANAGEMENT

1. Future carrying capacity of Komolonik after water development is estimated at 23,000 livestock units (LU).

2. Present carrying capacity adjustments by sections are as follows:

Ardai - increase 600 LU,
Monduli Juu - maintain present stocking rate,
Mfereji - reduce 600 LU.

3. Burning should be controlled and allowed only by permit.

4. Studies should be made of the following:

- a. effect of burning on Themeda triandra,
- b. effectiveness and cost of herbicidal control of Solanum incanum in Monduli Juu,
- c. effectiveness and cost of herbicidal control of Pennisetum straminium.

5. Develop planting schemes with Leucaena glauca for gully erosion control.

6. Eventually plan boma site locations to minimize erosion.

7. Develop watershed protection for all catchments as recommended (page 90).

8. Road access from Monduli Juu to Mfereji should be improved and maintained.

9. Fire breaks (detail, page 92) should be constructed as follows:
 - a. along Arusha-Dodoma road border,
 - b. from Ardaai Dam to escarpment below Lake Eluanata Hanja,
 - c. encircling the forest reserve.
10. Range land cropping must be minimized:
 - a. Cropping should stop on Ardaai by 1970,
 - b. Soil land use reconnaissance surveys should be conducted on Monduli Juu to determine desirability of cropping there,
 - c. The feasibility of high producing forage-legume combinations should be studied on better soils in Monduli Juu,
 - d. No cropping should be authorized in Mfereji.
11. The Ardaai "demonstration unit" should be utilized for applied research and as a holding ground for cattle should marketing activities commence.
12. The introduction of technical innovations to the Masai should be done with cooperative young elders in the boma-field environment.

ANIMAL PRODUCTION

1. Accurate detailed information must be obtained on herd composition production coefficients in Komolonik.
- 2.. A program should be developed to improve calf production emphasizing:
 - a. ECF control,
 - b. increased cow milk production;
 - c. surveying internal parasitism,
 - d. minimizing climatic stress.
3. Initiate study in Ardaai research unit with trace and major mineral supplementation.
4. Explore feasibility of feed preservation techniques (ensiling, legume grass mixture, etc.) for dry season feeding.
5. Do not divert resources into breed improvement projects until environmental conditions are markedly improved.

6. Survey disease incidences in Komolonik herds including:

- a. Brucellosis,
- b. internal parasitism,
- c. *Cysticercus bovis*.

This should be directed by the Veterinary Division.

- 7. Investigate the possibility of a more detailed survey on the locations of *Rhipicephalus appendiculatus* in Komolonik.
- 8. Tick challenge should be maintained in ECF free areas.
- 9. Consider additional dip at the edge of Ardaï plain if marketing operations develop at Ardaï unit.
- 10. Coordinate crush site placement by Veterinary Division with association area development.
- 11. Over-population of game and cattle in Loliondo Division requires a reduction in both. Game Division officials should be consulted to develop a program for reduction of game.
- 12. Emphasis should be placed on cattle production in association areas toward the eventual elimination of game.
- 13. Funds derived from collections by the Game Division should be directed to district councils to facilitate the reduction of market fees.

PROPOSED ASSOCIATION AREAS

- 1. Emphasis on association formation should focus on Kijungu, Loliondo, and Olmoti as well as Komolonik. All possible assistance should be given to the formation of these associations.
- 2. Felt needs, as seen by the Masai, should form the basis for establishment of an association. One association activity should be started at a time, with others following as the preceding one is well established.
- 3. Procedures for registration should be simplified.

KIJUNGU

4. Immediate attention should be given to registration of this area as one single association hinged around the development of dips, water, and marketing activity. Requirements of budget formation and stock quotas must be followed in establishing the association.

LOLIONDO

5. Discussions with elders councils on formation of a number of associations should be initiated immediately, considering as a primary approach the improvement of marketing.
6. Normal wet-dry season grazing areas outside the association boundaries and inter-tribal relationships should be given special consideration in setting up associations.

OLMOTI

7. Steps should be taken as soon as possible to register this association and expand the original planned area.
8. Tsetse population patterns should be thoroughly studied.
9. Additional water points should be established along with extensive brush control.

MARKETING

1. The Masai associations should form cattle marketing committees which will function on a continuing and regular basis to assemble cattle, arrange for buyer contact, facilitate vaccination, and possibly move cattle to buyer/exchange points.
2. Explore pilot-level programs of vaccination and identification of sale cattle on the ranching associations with the Veterinary Division. This could be the initial activity to foster ranching association development in Loliondo and possibly Kijungu.

3. Emphasize weighbridge selling, but only where such equipment can be maintained and protected against willful damage. This could be in association areas - Loliondo, Olmoti, Kujungu, Komolonik.
4. Do not encourage on-the-rail selling (carcass basis) by Masai initially in deference to selling by live weight.
5. Begin canning-type cattle sales to KMC over the weighbridge, particularly with Masai in Loliondo Division. This could be carefully initiated on a pilot-level basis with the guidance of Masai-accepted leadership in the area.
6. Reduce current market cess, charges, etc. markedly. Association marketing charges must represent only marketing improvement and operation costs.
7. Obtain market information regularly and at representative points on prices by estimated weight, types, and grades of livestock, and movements of these various types. A simple descriptive system should be used.
8. Set up a market development planning organization to review the present situation and advise on future market infrastructure development needs and to obtain the capital resources needed to improve the marketing system. It should not engage in the actual marketing of livestock.
9. Administer livestock marketing by an autonomous marketing section with its own funds within the Ministry of Agriculture.
10. Marketing-oriented and trained technical personnel should guide marketing activities.
11. Veterinary Division involvement in marketing should be limited to that required for disease control.
12. The marketing of livestock should become a matter for regional consideration with other members of the East African Community.
13. Allow individual buyers and traders to continue operating within an improved marketing infrastructure. With improved contract selling to KMC and TPC by Masai, the collusion should lessen.
14. Government should consider the proposal to reactivate on a reduced scale the Tanganyika Packer's Plant in Arusha.

15. A system of all-weather roads is essential for the development of an efficient marketing system and merits prompt consideration.
16. Holding ground location, design and function should be thoroughly reviewed before further developments are made.

PERSONNEL

1. For implementation of development programs, it is recommended that the following personnel be recruited:
 - a. Marketing Specialist,
 - b. Agricultural Engineer,
 - c. Livestock Production-Animal Health Specialist,
 - d. Extension Sociologist, and
 - e. Agronomist-Range Management Expert.

The team should be based at Monduli; its work should encompass all of the Masai District.
2. A Tanzanian Association Manager should eventually be obtained for each association.
3. Additional short-term advisory personnel may be required such as a soil survey specialist for the land use reconnaissance survey.

Situation and Discussion

MASAI CULTURE

Many writers have dealt with the cultural factors relating to the adoption of new technology and the introduction of cultural changes. The very nature of the culture influences what innovations will be adopted, the speed of their adoption, and the process by which adoption takes place.

By thoroughly understanding the cultural factors, the greatest amount of adoption can be achieved in the shortest length of time. Many factors should be seriously considered when studying a new culture - the process of decision-making, localities covered, leadership patterns, and values.

DECISION-MAKING

The Masai elders' main responsibility is making the political and social decisions of the society. In issues of major importance the young adult males (il-murran) may be consulted, but women and boys never are.

The meetings of the elders run to three basic types of decisions. One type deals with decisions relating to cattle care. These are usually made daily within a single boma and involve such things as where the herd should be grazed, which boys should do the herding, where and when the herd should be watered, and if a village move is warranted.

The second type of decision-making is in a kind of local court where disputes between members of the tribe are settled. The elders' decisions are final and carry all the weight of the society.

The third type of decision-making might be called "affairs of state". This involves entering into agreement with Government officials or other tribes or groups in the area. The elders as a group are the only ones able to enter into such binding agreements on behalf of the members of the Masai society.

The locality covered in a decision-making process will vary according to the type of decision and the number of the Masai involved. Decisions affecting an individual herd, family, or village will usually be made at the boma level. Most decisions involving the settlement of disputes, the punishment of wayward members, or entering into agreements are held on a locality basis.

Localities usually cover a number of square miles and involve a great number of bomas. The actual size of the locality varies according to geographic boundaries and normal wet and dry season grazing patterns.

There have been instances of representatives from all tribes getting together to discuss vital issues, but these have usually resulted from central Government pressures and are not normally carried on. The most vital unit for decision making, therefore, would be the locality where regular elders council meetings are held.

LEADERSHIP

The Masai society provides for leaders of the various activities involving their life. The most prominent of these is the person who serves as leader for the elders in the local elders council, where most of the important decisions are made.

The ritual expert is another leader and has a number of functions. First, he has the responsibility of effecting cures on ill persons and cattle. Secondly, he has the power to place--and remove--curses.

The third, and perhaps the biggest responsibility, is to serve as ritual expert to the Masai. The Masai can be said to have no chief and no hierarchy of decision-making except those awarded the elders. In this way, the process of decision-making by the elders resembles a representative democracy.

VALUES

The Masai have their own system of what they feel is important and what is considered good or bad. The Masai culture is built around cattle, since their very existence depends on their herds. Cattle provide food, clothing, and shelter, as well as cash.

In general, a man who has a large herd has a sense of well being because he feels secure, while a man who has many children receives praise from his neighbors.

The Masai place a great deal of value on quality of cattle in spite of the claims to the contrary. They are well aware of the benefits of improved stock and are quite interested in cattle that will do better under their conditions.

Cash is a form of wealth that the Masai are well aware of. However, the Masai do not attempt to accumulate large amounts of cash, but prefer to have their wealth in cattle so that they can receive the milk from them.

It may be said that the Masai are conscious of security since most of them are not willing to take high risks. This view seems logical in light of the natural risks of climate and disease they must endure. A new kind of Masai businessman or cattle dealer is developing. For the most part, these are il-murran who begin buying and selling cattle. It seems likely that there will be more and more Masai in the cattle business and some of them will likely take this as a permanent occupation.

The Masai place a particularly strong value on sharing. Whenever a man gains wealth or good fortune, he is expected to share it with his neighbors. If a steer is slaughtered, the meat is expected to be shared by all.

The Masai value honesty and fairness in their relationships with each other, but do not feel any such restriction on their relations with outsiders. Since they value honesty, they appreciate it in others and will deal fairly with those who they feel deal fairly with them.

The Masai believe that each man has an equal opportunity to participate in the affairs of the society. This is particularly true in the case of decisions affecting the group. When money is needed for a community project, all men pay an equal amount regardless of their wealth.

RECOMMENDATIONS

Anyone planning to work with the Masai on development plans should be prepared to spend immense amounts of time in the field, particularly for the first two years. Enough contact over a long enough period of time should be maintained to develop sound communications and trust.

Localities of decision-making should be identified. This can be established by determining where the local elders council (engigwana) meets and what area is covered by that particular council. A small research project should be conducted to identify all the localities covered by the elders councils throughout Masailand. Wet and dry season grazing patterns and tribal boundaries should be determined and mapped at the same time.

Identifying these localities is important since most of the decisions of Masailand are made at local elders councils. Any development plan or change program ought to start with these councils. Care should be taken to not split localities in designing programs. The Masai should be given full details, regardless of the time it takes, and then be permitted to reach a decision in their own way.

The people should be allowed to determine the things of greatest concern to them and what they would like to do about them. Simple, easy-to-complete projects involving low cost and low risk should be started first.

The power of the age-sets should be kept in mind when working with the Masai. Particular attention should be given to the bond between alternative age-sets. The alternative age-sets are used to working together so it might be advantageous to work with them as a group. Attention should also be given to the leaders of the age-sets since they are often opinion leaders.

For further information about Masai cultural patterns refer to Appendix II.

ORGANIZATION OF RANGE DEVELOPMENT

RANGE COMMISSION

In 1964 the Tanzanian Parliament passed the Range Development and Management Act which was supposed to provide the legal basis for increasing livestock production and improving land use on the 155,000 square miles of grazing land in Tanzania. The Act authorizes the Minister of Agriculture, with approval of the National Assembly, to designate range development areas within the country. The Act also requires that a Range Commission be established in each development area to be responsible for rehabilitating, conserving, developing, and improving the natural resources in its area. The Commission is appointed by the Minister of Agriculture and its composition is left to his discretion.

The law was used first to establish the Masailand Range Development Area in 1964. It covers approximately 24,000 square miles, has a population of around 100,000 people, and over 900,000 cattle plus large numbers of wild animals and small domestic stock. In 1968, the Minister of Agriculture established six additional range development areas in Gogoland and Sukumaland.

The Masai Commission was appointed first. In appointing the Commission, the Minister tried to select some members who were recognized political leaders and were acceptable to the Masai. One such representative was selected from each of the five divisions in the Monduli District to serve for three years. Six existing district government officials were made ex-officio members of the Commission: the Area Commissioner, Chairman of the District Council and TANU, Regional Water Engineer, Conservator for Ngorongoro Game Reserve Station, Regional Agricultural Officer, and Member of Parliament for the District. The Area Commissioner (head of the District Council) chairs the Commission.

By law, a Commission is directly responsible to the Minister of Agriculture who may discharge, replace, or declare it in default. The Masai Commission policies are implemented by the Commission Secretary assisted by the Range Management Officer, who is responsible for technical recommendations.

Commissions have two primary functions: (1) to prevent undesirable practices, and (2) to develop range areas through ranching associations.

In order to preserve existing resources, a Commission may control residence and settlement on its range development area. It may also control cultivation, grazing, and the use of water in order to prevent soil erosion and preserve grasslands.

RANCHING ASSOCIATIONS

The GOT has decided that the best way to develop its ranges is by establishing ranching associations. Preparatory to forming a ranching association, the Commission should (1) examine its entire area, holding discussions with prospective members; (2) choose areas it considers suitable for ranching projects; (3) have them surveyed to determine their potential and report the results to the Minister; and (4) after considering these reports, choose an area or areas for a ranching association.

It then should have plans prepared for the development of the project area and for the formation of a ranching association to manage it. These plans cover such subjects as the boundaries of the ranching projects, a description of the development work to be done by the Commission and by the proposed association, and an estimate of the existing stock units and the number which will be permitted.

After the proposal is completed, Commission members are required to explain it thoroughly to the proposed membership. The association is not registered until 60 percent of the proposed membership approves the proposal. If they do not, the forms may be revised to remove the objectionable points and the proposal voted upon again. Or the matter may be dropped.

If the proposal is approved, it is announced by the Commission and one or more of the prospective members applies to have the association registered. Following registration, prospective members must apply to become actual members, and when 60 percent do so, the ranching association is entitled to (a) have the land allocated to it, or (b) to receive a right of occupancy for 99 years, and (c) those water rights included in the approved proposals.

Once registered by the Commission, the ranching association becomes a corporate body capable of suing or being sued, capable of holding, purchasing or otherwise acquiring and disposing of property. It also has the power to buy and sell stock, agricultural machinery and tools, agricultural products and seeds and other goods, to keep and graze stock on association lands and to reserve part of its ranchlands for an exclusive ranch to be maintained and operated by the association.

Associations can also provide a community center for adult education, local shops for purchase of supplies, dispensaries, and better school facilities.

A ranching association is responsible for controlling and developing its land for the continuing benefit of its members. For this purpose the association is required to make by-laws and submit them for the Commission's approval, along with the application for registration. By-laws must state the number of stock units allowed for each member, and for the association itself (if it is to keep stock), the total of which can not exceed the number authorized by the Commission. The by-laws may also cover association functions, implementation of any range management scheme, prevention of bush fires, dipping of livestock, method of paying fees, and method of determining livestock quotas.

In 1968, regulations were published governing the formation of ranching associations. The regulations include forms for the surveys, forms on which to describe the ranchlands, proposed water rights, developments, certificates of registration, etc. The regulations require that each association be managed by a managing committee elected annually by the members.

The team is in agreement with the 1968 UNDP Livestock Mission Report which concluded that the Act and its regulations are extremely complex and should be simplified.

DISTRICT COUNCIL VS RANCHING ASSOCIATION

District councils have responsibility for administering local governmental affairs. They are composed of 30 members elected by the people, plus an elective officer appointed by the President of Tanzania. The Chairman is elected by the council; other officers are appointed.

The Masai District Council has certain mandatory obligations (for example, roads maintenance) and may assume responsibility for other activities such as marketing and water development.

The district council operates on tax levies on individuals (personal rate), and cattle cess, both collected at cattle markets. The amount of the personal rate tax varies from 0 to 80 shillings based on ability to pay. The council also receives income from a share of the receipts of the Game Division.

The district councils have been criticized for their failure to function efficiently and this is justified in a number of instances, at least where marketing services are concerned.

The creation of a ranching association brings up the question of authority and responsibility in matters involving the areas of the association. As associations develop and begin to provide their own services should they be expected to continue to provide the same funds to the district councils which no longer are expected to carry out these functions? The marketing of livestock by a ranching association committee is an example of this. The committee would provide services and the association members would be expected to pay. It would seem reasonable then that Masai not be expected to pay the usual marketing charge (8 shillings) to the district council but to retain some of this for payment for, and improvement of, association marketing services.

Recommendation

It is suggested that GOT consider this matter of district council authority and responsibility in association areas, recognizing that association autonomy and flexibility of action are needed for their maximum development.

Care must be taken to coordinate planning between association development areas and activities of the Ministries of Agriculture and Land Survey and Water Development. Careless planning of capital improvements, crushes, water points, etc. could undermine the efforts to develop the ranching associations. Masai will see little value in making concessions of their own necessary in forming an association under the Range Commission if they see evidence that another division of government is going to come in with capital inputs in an adjacent area.

MARKETING

Studies of marketing systems affecting Masailand by necessity involve all phases of cattle marketing in Tanzania. In view of the pending long range agricultural marketing studies to be conducted in depth by USAID and FAO teams, attention in this report is given primarily to recommendations which might correct obvious problems and weaknesses in market infrastructure in Masailand itself and increase reliability in value being paid at the primary point for cattle.

GENERAL MARKETING CONSIDERATIONS

Marketing services can affect the level of demand and thus prices paid. As a rule, high marketing marginal costs and profits can lower producer incentives and can also cut down on the rate at which supply affects the demand. Usually higher marketing margins result from inefficiency, high cost requirements for marketing services, and collusion.

Conditions for collusion in livestock marketing are favorable when (1) entry into the market is difficult and when (2) the market is rather narrowly defined, that is, there is little effect of the one market's activities, on another market's prices, etc. This can be caused by poor transportation, poor communication, erratic market schedules, or other conditions present in Masailand which limit the ability of individual traders to operate freely. Also the ability of producers to enter at various points in the marketing channels could have a stabilizing effect on prices.

MASAI DISTRICT LIVESTOCK MARKETING SITUATION

Until gross malfunctions in cattle marketing are corrected, the Masai cannot be expected to accept programs designed to increase productivity of their cattle. Low and variable prices discourage the selling of cattle by the Masai, even though these people are not commercially oriented.

The problem is not the lack of demand for cattle. Processors (TPC, KMC) need cattle for slaughter on a year-round basis and the local consumption is expected to increase. Per capita incomes are increasing and the income elasticity is high for agricultural products. Consumption of beef in Tanzania is expected to increase at least 4 percent per annum for the next 5 years. Urban and institutional demand for higher grades of beef is rising at 7-8 percent per annum and will be even higher.

Prices paid for livestock are highly variable and are apparently subject to collusion and to the effects of higher death loss risks for the cattle trader in moving stock to secondary markets for further movements to slaughter. Communications are poor and transportation is seasonally erratic. Much of the difficulty in marketing arises from a poorly developed marketing infrastructure.

Location of primary markets is shown in Figure A. Stock routes have been developed with bomas, water points, and holding grounds, but which, at a number of points, are in a state of disrepair or malfunction. For example, five of the bomas from Loliondo to Makuyuni are in disrepair.

Some district councils have not effectively maintained the facilities for which they collect fees. Low cattle marketing through regular sales provides insufficient operating capital, also aggravating the low maintenance level. The situation has deteriorated to the point that local and national government personnel ask "why develop a marketing system if the Masai don't use it?," or "will the Masai use the bomas and water points if they are improved and functional?"

Taxes, political dues, and market fees are collected at the market place and this practice constitutes one of the major obstacles to the development of an orderly legal marketing system.

Assessments are sometimes made for vaccinations whether cattle are vaccinated or not. This situation is further complicated by variations in market fees at different points. Thus the Masai producers simply have no faith in, and resent, the existing market system.

The low prices paid for cattle, coupled with the district council tax and other fees, have prompted the sellers to operate outside the regular markets. Buyers often operate illegally, saving their own 5 percent buying charge and allowing the Masai to avoid their assessments. Cattle change hands frequently, are moved along remote tracks to avoid detection, and find markets in Kenya and with bush butchers.

Controlling cattle disease in Masailand is difficult. This difficulty is caused partly by the vastness of Masai District and the intermixing of Masai cattle and cattle from other areas, Mbulu, Korogwe, Dodoma; the poor road system; the lack of veterinary crush facilities; and the need for increased field participation by veterinary personnel.

The Veterinary Division utilizes the quarantine within the marketing system to help control the more infectious diseases by holding cattle fol-

lowing vaccination at primary (first point of assembly and sale) or secondary markets. Cattle are then allowed to move directly on to consuming areas. The Veterinary Division is in a particularly difficult position on this as this quarantine program actually may stimulate the illegal market. Furthermore, the holding period causes marked stress to cattle in areas where feed is scarce and water supplies erratic. Thus attempts to control animal disease and shrink may in some instances actually intensify the problem.

Practically all cattle are sold on a live basis and are bought by the head. A weighbridge exists at the Temi holding grounds but is inoperative.

Marketing Costs and Margins

The marketing margins are high, at least between prices paid in remote areas of Masailand such as Loliondo and Kijungu and the actual meat retail value. As an example, it has been projected by Broadbent and Anderson that if 15,000 head of cattle from the North Mara area were all sold in Dar es Salaam, the major transport and marketing costs would be worth almost half the value of slaughter stock sold and this does not include the costs of death loss, which at certain times is substantial.

Available market information is scarce, and what is available does not provide prices on a per-size or finish basis. Under this situation, it is difficult to trace demands and margins for various kinds of cattle. Therefore, efforts were made to compare prices paid at various points for cattle of certain degrees of fatness and weight as evaluated by Deans and a Masai cooperator. It was not possible to develop this study in depth, but some preliminary data was collected.

The following is a comparison of prices paid for steer cattle purchased by Somali traders at Loliondo and by butchers and traders at Arusha:

Loliondo	475 lb. steer cattle value	110 shs.
Arusha	" " " " "	175 "

Arusha cattle therefore have live value/lb. of 36¢ with a carcass cost of 72¢ (assuming 50 percent cold carcass yield). On the same slaughter yield percent value (comparing cattle values prior to shipping shrinks) Loliondo immatures are bringing 23¢/lb. live wt. with a 46¢ carcass cost. Thus, differentials of 65 shs. a head exist between similar type cattle in the two markets (200 miles apart). (Some loss in condition may occur between points and affect values. This is taken into account to some extent in the 15 percent loss figure.)

Costs of marketing cattle from Loliondo to Arusha are roughly:

	<u>Per Head</u>
Trekking - 1¢/head/mile @ 200 miles	2 shs.
Traders livestock permit	3 "
Vaccination	2/50 shs.
Market fees (seller) Loliondo	8 shs.
" " (buyer) 5 percent of value	5/50 shs.
Shrink, estimated <u>1/</u> 15 percent of value of marketed cattle = 71 lbs. @ 23¢ 1b. =	16/33 shs.

(Such shrink may be reflected in death, live weight loss in "fill", and tissue shrink. Cattle dying enroute are frequently consumed in the local area and some salvage earned.)

Market fees - Arusha <u>2/</u>	<u>2 shs.</u>
Total marketing costs	39/33 shs.

Thus the spread in value of 65 shs. minus 39/33 shs. cost of marketing results in a margin of 25/67 shs. per animal for the intermediate handler. This is approximately 23 percent mark-up in margin, which includes the losses to be expected in a normal marketing transaction. A large part of such income could be earned by associations if a degree of excellence can be achieved in the marketing of cattle.

Market Demands

Specific demand patterns by butchers for certain types of cattle vary by area.

1/ Broadbent and Anderson.

2/ Selling charge for Loliondo cattle arriving for sale at Arusha.

Butchers servicing the Moshi-Arusha area show a decided preference for heavier fat steers and bulls, paying from 550 to 700 shillings for desirable type cattle. The high value obtained from beef fat (4 shs./lb.) and the preference for fatter beef by Europeans and Tanzanians in the Arusha-Moshi area support this relatively strong market. Best estimates indicate a rather constant yearly demand for the heavy cattle. When considering boneless meat costs -- based on the Arusha market -- the heavy bulls and steers show a 1 shs. 65¢ 1/ boneless cost, not considering the credit value for fat. This compares with a boneless cost figure of 1 shs. 2/ for the lighter younger cattle.

The premium value of meat from heavy cattle raises the question of whether the Masai producers can afford to supply this market. This is discussed under "Production Potentials."

Lighter, thinner, less expensive cattle are bought by slaughterers with limited resources and with the aim of rapid cash turnover and thus with some speculative element involved.

Seasonal condition and type demands exist in Tanzania and Kenya. The low prices paid in more remote areas of Masailand do not reflect a lack of buying pressure at central points. Tanganyika Packers Ltd., Dar es Salaam and the KMC plants at Athi River and Mombasa, Kenya, need canning types of cattle to maintain volume. Canning operations at all these plants are managed by Liebig. Tanganyika Packers, Dar es Salaam, offer to buy cattle on a cold dressed weight basis at the rate of 87, 97, or 1.05 shs. per pound. The heavier but lean types of cattle are most desired. In general, this provides an outlet for cull type stock but does present the problem of such cattle being able to withstand shipping. Losses run high -- 20-30 percent if delays occur enroute.

Producers in the northern part of Masailand pay high selling costs for light cattle in Dar es Salaam because of higher transportation costs. This is illustrated by the following:

(1965 prices)

Wt. of animal	Live wt. price/lb. *	Value-shs. *	Producer receives
800	.50	400	280
700	.45	315	165
600	.425	255	135
500	.375	187/50	67

* Source of data: Broadbent and Anderson.

1/ Assuming 54 percent dress and 75 percent yield.

2/ Assuming 50 percent dress and 72 percent yield.

Furthermore, such cattle are often weakened by nutritional stress with losses higher than younger, stronger types.

The volume of cattle shipped from northern areas amounted to only 1.7 percent of all cattle bought by Tanganyika Packers in 1967.

The rail movement of cattle does not at this time avoid losses. Delays in transit where cattle loaded are not off-loaded for water causes considerable stress. Rail schedules are such that at least two days are required to move cattle from Arusha to Dar. A marked improvement in rail movement of cattle would do much to reduce losses.

The existing market outlet for cull type cattle in northern Masailand is poor.

MARKET POTENTIALS

Marketing Alternatives

Arusha Abbatoir Consideration

The movement of cull type cattle to Dar es Salaam is expensive considering the losses that can occur and the cost of transportation. It is most important to develop a viable market for cattle in northern Masailand.

The Tanganyika Packers' plant at Arusha was closed, apparently because of insufficient volume. The plant has a five-bed killing floor and extensive by-product processing and canning facilities. However, much of the machinery has been removed and the buildings are in a general state of disrepair. The plant site has water, electricity, and railroad access and could be reopened with modification. Private investors could process cattle for the Arusha-Moshi area -- offering warm dressed beef for sale to butchers (retail) and shipping surplus beef to Tanganyika Packers, Dar es Salaam, by refrigerated transport.

This would involve refrigeration and power costs, but would be offset by the saving in death loss and shrink of canning cattle and by the value of the increased volume of beef required for canning at the Dar plant.

While the Dar plant needs more cattle on a regular basis, the Arusha slaughter outlet should be reactivated for increased take-off.

The incentive to sell cull cattle is needed in Masailand. As very few cattle move from the Northern Region to the Dar es Salaam plant, the volume effect on the receipts of live cattle at the TPC-Dar plant would not be great.

Improvements in the Moshi-Dar es Salaam highway would enhance the movement of cattle from the north to the Dar area. However, it is questionable whether this will result in the movement of larger numbers of cull cattle from the northern section of Masai District, because of the transportation costs, shrink, and cattle stresses involved.

Kenya - Dalgety Cattle Purchasing Plan

The northern and central part of Masailand should take advantage of a recent arrangement between Kenya and Tanzania to provide cattle for sale by the pound over a weighbridge at Arusha. These cattle are assembled at Taveta for onward movement to rail loading points for shipment to Athi River or Mombasa. Prices are set on a live basis with all types of cattle being priced similarly. Prices vary with the number of cattle offered for sale, ranging between 36 and 39¢/lb. live weight. Under this plan cattle must be vaccinated, held for a quarantine period, and must then not pass through another quarantine area enroute to Kenya.

Masai Association Marketing Committee

Alternative outlets for Masailand cattle are available at stronger prices if groups of cattle are assembled for direct sale.

This suggests that associations could effectively increase their bargaining power by forming cattle selling "committees". These committees could act as liaison agents, advising buyers of cattle offerings and making known to association members the requirements of the buyers, thus providing a valuable marketing service.

Requirements for vaccination SAT II, A&O foot-and-mouth and Blanthrax could be met with a minimum of stress as cattle can be assembled, vaccinated and maintained for the 21-day holding period under favorable conditions. Providing "fresh" cattle could further enhance the bargaining position of the association.

A real difficulty may arise in assembling enough similar type cattle from one association to create sufficient buyer interest. Buyers have agreed to pilot-type activities to test the feasibility of such a scheme. Perhaps an association committee could act as agent for Masai cattle outside the association and assemble sufficient cattle. Such cattle would likely have to be vaccinated and held at an assembly point outside the association. The underwriting of possible losses of cattle during the holding period might be a justified responsibility of the association in return for income from cattle head payments or from sale fees collected

by the association. If prices are adequate and the use of the money collected is visual, the Masai may support such a scheme.

Care must be taken initially to select cattle that are lighter and thinner - more mature but of sufficient condition to withstand normal trekking. KMC-Dalgety has provision for rejection of extremely poor cattle. A selected group of elders and murran should talk with potential buyers and especially to the plants at Dar es Salaam and Athi River to learn the needs and buying arrangements.

Immature Sales - National Development Corporation (N.D.C.)

An outlet for younger cattle lies in the need by N.D.C. and private interests for cattle for feeding or "fattening" purposes and for export. This is a grass-type feeding program. N.D.C. has six ranches, two of which are engaged in feeding purchased immature cattle - Ruvu and Kongwa. The development of the fattening ranch concept is being supported by IDA Development Credits. The N.D.C. ranch at Ruvu occupies 64,000 acres and can use 10,000 to 12,000 cattle on a year-round basis, reducing seasonal price fluctuations. The program there is concerned with 6-12 months feeding of light bull and steer cattle.

In discussion with Middleton and Robertson of N.D.C., the possibility of selling vaccinated immatures by weight was considered. In addition, comparative feeding trials could be undertaken with association cattle comparing superior castrates or young bulls with regular groups of immatures. Such cattle should bring a higher price if performance is superior. This may be too "sophisticated" and must be thoroughly discussed with association members. Furthermore, Masai have not traditionally sold off their good young castrates. However, such an endeavor might be appealing considering the Masai interest in superior cattle.

Marketing Organizations

Other Tanzanian reports (Broadbent and Anderson UNDP Tanzanian Memorandum) have mentioned creating marketing boards for livestock and meat. Also, legislation has been proposed to provide for a new livestock and meat marketing system.

There is no doubt that resources are clearly needed for capital improvements in the market infrastructure. If marketing agencies can create sufficient GOT interest, the allotment of government funds would seem justifiable. However, the actual conduct of marketing can represent a cost input in recurrent expenditure of approximately 1,000,000 shillings (Broadbent and Anderson) and this does not include the money needed for capital items.

Furthermore, the marketing of livestock requires a great deal of skill, knowledge, flexibility, and organization to be successful and thus is dependent on trained, experienced individuals. The mere presence of a marketing board does not create these resources and talents. Decreases in efficiency and accuracy occur when systems are created in which the individual at the point of contact is restricted by lack of flexibility and/or mobility.

There is a need for people with a feeling for livestock marketing beyond the routine imposition of quarantines, fixing of market fees, or recommendation of quotas, etc. The knowledge of what is actually occurring in the daily marketing of livestock and a familiarity with the personnel buying and moving livestock are essential. Thus it is strongly recommended that the marketing of livestock be studied and administered by marketing-oriented and trained people.

It is doubtful that a government marketing organization can decrease the losses in the marketing of cattle until the infrastructure deficiencies are corrected.

Problem Areas

For purposes of emphasis, the following are considered separately:

Roads

Without more all-weather roads, the degree of advancement which Masailand can attain will be severely limited. All-weather roads allow for availability of parts and maintenance personnel for water systems, supply of vaccines, drugs, and veterinary personnel. These services are essential if livestock are to be accurately priced, moved with minimum loss, and accepted by outside markets.

Specific road priority recommendations are as follows:

- a. Monduli - Naberera - Kibaya - Kijungu, commencing from the Monduli area, with the strong Arusha, Kiliminjaro market.
- b. Kenya border - Loliondo - Ngorongoro .
- c. Kijungu to Handeni.
- d. Naberera to Ngasumet.
- e. Kibaya to Kidete.

Holding Grounds

The design, carrying capacity, isolation, and management of holding areas must be thoroughly reviewed. Holding grounds could be a source of disease contamination and stress if not properly designed and managed. Not all diseases are controlled by dipping and by vaccination. Furthermore, dry-season feed reserves must be effectively planned for, along with carrying capacity. Over-stocking such an area must be avoided, particularly when a quarantine is imposed.

Severe difficulties and losses arise when holding areas have little feed or water. Under such conditions, quarantines can invoke greater losses than would normally be encountered. They also give encouragement to the black market movement of cattle.

The provision for stored feedstuffs such as locally available silages, by-products, feeds, crop residues, molasses, etc., should be considered, with grazing fees carrying the cost.

Holding Area Location

There are presently no holding areas around primary markets. Thus, cattle are either shunted to the holding grounds at Temi or Makuyuni and are often held under severe conditions.

A thorough study should be made of both the short-term quarantine and longer-run conditioning and feeding-type holding areas concepts. Consideration is necessary by representatives of the Agriculture Division, the Veterinary Division, and representatives of the Range Commission steering committee and the technical staff in the Range Commission (on

the marketing organization as recommended). Properly planned and managed holding areas would effectively cut transit losses and minimize the illegal market.

Identification

Unalterable identification of vaccinated cattle is a vital link in the system and is a most difficult problem. Freeze branding has been suggested. This system creates a distinctive mark, but solid carbon dioxide is not yet readily available in remote Masailand. Moreover, this is a sophisticated technique and its reliability for East African conditions is questionable.

The GOT should study the feasibility of establishing a brand registry within the pattern of the existing nomadic marking systems. Brands can be altered, however, particularly when such a diversity of brand marking systems exists. Registries do create, however, a sense of organization and might eventually be feasible.

ANIMAL PRODUCTION

The Masai in more remote areas have struck a working balance between their way of life and their environment. Their livestock production system is not an economic enterprise - it is their source of subsistence using the grass of a land suited for grass alone. Therefore, the range of alternative methods and practices available to them is narrower than for those who have less severe environmental conditions and who are not reliant upon cattle alone for their sustenance.

Much of the animal husbandry in Masailand hinges around the availability of water, presence of disease contamination areas (East Coast Fever, trypanosomiasis, malignant catarrhal fever) and dry-season grazing. The Masai are extremely clever at manipulating their cattle management around these factors.

NUTRITION, MANAGEMENT, BREEDING

Nutrition

The prime limiting nutritional factor is quantitative - a "feast or famine" grass situation. The Masai use the standing hay principle to provide feed during the dry season. When dry-season conditions are not extreme, cattle maintain reasonably good condition. However, abnormally poor conditions seriously affect the performance of breeding stock as well as killing susceptible livestock.

The Masai constantly need a certain proportion of their herd in lactation. Therefore, a system of feed carryover or storage offers the greatest promise of stimulating cattle production. Silage making methods such as surface ground packs might be economically feasible.

Protein, Vitamin A, and mineral deficiency and imbalance are likely to be the greatest nutritional problems under Masailand conditions of dry-season stress. Improvements should produce dramatic results, particularly in conception and calving rate. Studies in northern Nigeria by Miller (1960) have indicated that protein deficiency in dry-season pasture causes the greatest weight loss. Carotene (Vitamin A) effects to stimulate weight gain were dependent on protein intake levels.

Marked responses have been obtained from mineral supplementation. However, there is a tendency to use mineral supplementation with little

regard for existing water, soil, and ration mineral content. Since inter-relationships in mineral nutrition can cause negative effects, nutritionists must be consulted in planning survey studies and research-demonstrations. Mixtures of 90 percent salt and 10 percent phosphate produced increases in gain of 4 pound per day in trials reported by V. Bunderson, UNDP, in Kenya. These responses were obtained with adequate water and dry matter and illustrate what can be done to bring more dramatic responses when all the supporting requirements are present.

When feed supplies are limited and if there is a choice as to when they can be used, Wiltbanks studies (1962) show that the most effective time is in the period following calving.

Calf Production

There is frequent evidence of poor performance, high mortality, and poor condition of young stock. Calves must compete with humans for milk which complicates seasonal calving. Furthermore, immunity is low in young calves which are quite susceptible to a number of disease stresses, particularly ECF and foot and mouth disease. To illustrate, the "calving" rate per adult female is 26 percent for Monduli Juu where ECF is present, whereas the average rises to 38 percent in Mfereji where ECF is not found.

The Masai report that losses are heavier when calves are 3 months old. This indicates the possibility of heavy internal parasitism such as neo ascaris.

Calves are often grazed around bomas because Masai lack sufficient herding personnel. Such practices can lead to high infection rates where internal parasites are present. As the Masai tend to concentrate in one area, the parasitism in calves can be expected to increase.

Often calves remain in bomas exposed to the stressing effects of radiation and insufficient water.

The nutrition of the young calf is critical. The Wardrop (1966) study showed that stunting can occur after relatively short periods of low plane feeding immediately after birth. The critical period may be during the non-ruminant stage, i.e., birth to 3 weeks. Many studies have confirmed that prolonged malnutrition in the first 8 to 12 months of post natal life causes permanent stunting of cattle (Eckles 1946, Brooks and Vincent 1950, Crichton et. al. 1959).

One of the best illustrations of adequate calf nutrition can be seen in the high performance of the "improved" Boran and Sahiwal cattle at the George Damm Ranch at Manyara. His steers weigh 900-1,000 lbs. at 3-4 years compared to the average 600-700 lb. animal. It should be added that milk is not taken from cows for human consumption. It is likely that young calves are getting the essential nutrition early in their life.

Sheep-Goat Production

The emphasis focused upon cattle development in Masailand overshadows the role of sheep and goats in providing income and subsistence. When considering meat/live value, the potential for sheep-goat production is good. The market value of slaughter sheep and goats averages 35-40 shillings. When compared with cattle values on a live weight basis (ex. 475 lbs. @ 175 shs.), the goat value of 50¢ per pound (80 lbs. @ 40 shs.) is higher.

Management of small ruminants includes seasonal breeding and selective grazing practices. Control of internal parasites is neglected, but the dilution factor in grazing is high.

A goat breeding project is underway at the West Kilimanjaro station to increase lactation while maintaining a satisfactory viability and growth characteristic. No data is being collected, however, on nutrition or water requirements and this should be done.

Toggenberg strains have been used successfully by small operators with sales values being high (60-80 shillings per animal).

Breeding

Government has considered the development of bull breeding stations for "up-grading" beef cattle. Artificial insemination has also been mentioned as a means of improving the livestock productivity of Masai District.

At this stage in the development of Masai cattle programs the major limiting factor is environment (in the technical sense, i.e., non-genetic) not breeding. It is unlikely that "superior" genetic capacity to grow, milk, etc., will be noted unless the inputs necessary for higher production are met.

Breeding projects are not simple things, as they require substantial inputs to standardize environmental conditions and also cow herds of uniform numbers, types, etc. necessary to minimize bias. Projects are underway by NDC with IBRD support to develop "breeding" ranches and this could be a source of "improved" bulls for Masai. The Veterinary station at Mpwapwa is involved in bull testing and hybridization work and has a capable Tanzanian animal scientist working with this project. Improvement in genetic capacities will increase cattle productivity in some situations, but the concern here is allocation of limited resources where the return is greatest. To allocate limited funds to sophisticated breeding or expensive artificial insemination projects is inadvisable when the marketing, nutritional, and disease problems are so acute.

PRODUCTION POTENTIALS

Initial efforts in Masai District should be concentrated on (1) increasing the numbers of productive animals, and (2) increasing the productivity of the existing livestock. The factor of increasing weight entails proportionately higher*TDN requirements and with the NDC and sisal estate needs for immatures for feeding, the increasing of weight should be done by these sectors of the Tanzanian beef industry.

The following projections reflect the above and take into account the existing communications, management, and physical resources in Komolonik. The following model is developed from existing, questionable survey information. To study such a projection in detail is not justified but it is presented and qualified so that an estimate can be made of the costs and effectiveness of such an improvement program.

Existing Herd Composition

Data available on the Komolonik cattle population is shown in the following table. This information is lacking in detail. For example, calves and yearlings are combined and listed as "calves" and all castrates are combined into one figure. This presents problems in determining range requirements with the marked difference in nutrient requirement between young and mature cattle. However, projecting the herd composition for the five-year period, estimates were made of these age and class groups.

* Total Digestible Nutrients

TABLE I
Estimated Herd Composition -
Komolonik Ranching Association

Monduli Juu Area

<u>Bulls</u>	<u>Cows</u>	<u>Castrates</u>	<u>Heifers</u>	<u>Calves</u>	<u>Sheep</u>	<u>Goats</u>	<u>Donkeys</u>
643	4314	906	1139	1117	1783	3044	785
7.9%	53.1%	11.1%	14.0%	13.7%			

Total Cattle - 8119

Cows/Bull - 6.7

Calves/cow - .26 (including yearlings)

Ardei Area

383	2013	797	797	658	540	655	410
8.2%	43.3%	17.2%	17.2%	14.2%			

Total Cattle - 4647

Cows/Bull - 5.3

Calves/cow - .33 (including yearlings)

Mfereji Area

320	2292	523	733	862	1447	2000	597
6.8%	48.5%	11.1%	15.5%	18.2%			

Total Cattle - 4730

Cows/Bull - 7.2

Calves/cow - .38 (including yearlings)

Mjini Township

65	388	281	171	175	238	441	42
6.0%	35.9%	26.0%	15.8%	16.2%			

Total Cattle - 1080

Cows/Bull - 6.0

Calves/cow - .45 (including yearlings)

TOTALS

1410	9007	2507	2840	2812	4008	6140	1834
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TABLE II
KOMOLONIK HERD PROJECTIONS - COMPOSITION

Existing Herd Composition				5 Year Projected Improvement Effects			
Class	Number	Percent All Cattle	Percent All Livestock	1/ Stock Units	Percent All Cattle	Percent All Livestock	Stock Units
Bulls	1,410	7.6	4.6	1,410	950	4.0	2.5
Cows	9,007	48.5	29.5	9,007	9,500	40.0	25.3
Castrates 2/3	2,507	6.1	8.2	2,507	1,293	5.5	3.4
Castrates 3/5		7.4			1,000	4.2	2.6
Heifers 2/4	2,840	15.3	9.3	1,420	1,785	7.5	4.8
Heifers 3/4					1,660	7.0	4.4
Calves					2,180	9.2	5.8
Calves	2,812	15.2	9.2		2,095	8.8	5.6
Yearlings					1,983	8.4	5.3
Yearlings					1,437	6.1	3.8
Total All Cattle	18,576			14,344	23,883		14,466
Sheep	4,008			13.1	802	5,000	13.4
Goat	6,140			20.0	1,228	7,000	18.7
Donkey		1,834		6.1	3,668	1,834	4.9
Total All Species	30,558			20,042	37,717		20,534

1/ Stock Units: Bulls, Cows, Castrates - 1 unit each; Heifers - .5 units; Calves and Yearlings - 0 units; Sheep and goats - .2 units; and Donkeys - 2 units.

TABLE III
KOMOLONIK HERD PROJECTIONS - VALUE

Existing Herd Value and Sales

Class	Existing Herd Value and Sales				5 Year Projected Improvement Effects			
	Number (Shs.)	Total Value (Shs.)	Unit Value (Shs.)	1/ Sales (No.)	Total Sales (Shs.)	Unit Value (Shs.)	Number (Shs.)	Total Value (Shs.)
Bulls	1,410	450	634,500	93	400	37,200	950	600
Cows	9,007	250	2,251,750	650	2/	80	52,000	9,500
Castrates 2/3	2,507	326	817,282	1,114	290	323,060	1,293	175
Castrates 3/5							1,000	500
Heifers 2/3							1,785	250
Heifers 3/4							1,660	300
Calves							2,180	75
Calves							2,095	55
Yearlings							1,983	100
Yearlings							1,437	80
Total All Cattle	18,576	1,296	4,468,372	1,857	770	412,260	23,883	2,485
Sheep	4,008	40	160,320	601	40	24,080	5,000	40
Goat	6,140	35	214,900	921	35	32,235	7,000	35
Donkey		1,834						1,834
Total All Species	30,558	1,371	4,843,592	3,379	845	468,575	37,717	2,560

1/ Estimated take-off pattern = 60% castrates; 5% bulls; 35% cows.
2/ Cow culling & death salvage value to Masai set at 80 shs.
3/ Estimate selling 1/3 of heavy steers annually.

Incremental herd value-1,758,918
Sales differential-135,640

This lack of reliable detailed data on herd composition is not meant as criticism of Range Commission personnel. It is very difficult to get such information and usually requires a well organized, separately staffed project, such as that underway in the Range Development Project in Kenya.

The projected five-year herd composition figures were based upon production coefficients. When compared to cattle herd performance coefficients projected by UNDP, Kenya, and IBRD, these estimates are modest and yet must be considered as a very maximum for the Komolonik Association for the period.

Projected Herd Expansion

The generally poor calf performance at Komolonik must be the first phase of the herd production system to be improved. Therefore, change was programmed to reduce the number of mature bulls, increase the calving rate from 31.2 percent to 45 percent and reduce younger cattle mortality. The table shows the numbers of young cattle comprising the herd has more than doubled with 10 percent reduction in the bull and cow proportion. Culling would have to be practiced on cows and bulls and this has been set at 7 percent. With improvement in calf production and increased culling the numbers of productive cattle will increase. The cow herd base was established at 9,500 head, assuming that all increases in heifer production would be added to the breeding herd.

The data reflect an increase in calf viability and productivity with emphasis on the selling of younger steer cattle. This, of course, will require an effective marketing program and fair prices for such cattle. As no reliable information was available on existing marketing rates of cattle in Komolonik, a flat 10 percent estimate was used. The extraction rate in the projected example is 10.5 percent. This is a question of the willingness of the Masai to selectively market in groups of specific types of cattle. In 1969 this is unlikely.

Sales values have been increased year one through year four to account for the required reduction in bulls and heavy castrates. The effects of improvement in breeding herd productivity will not yet be shown in sales increases as efforts have been directed at changing herd composition.

Maintenance (TDN) Requirements

Of particular note is the effect which herd expansion in this manner has upon feed requirements (expressed here as Total Digestible Nutrients - "TDN").* The 28.6 percent increase in cattle numbers has required an increase of 19.7 percent TDN for maintenance. This in effect provides a herd in which a relatively higher proportion of the feed (TDN) consumed is being utilized for productive (growth, milk) purposes, a result of reducing the proportion of adult cattle.

* Daily TDN maintenance estimates: Calves 1.2 lb.; Yearlings 2.2 lb.; Heifers 2/3 yrs 3.3 lb., 3/4 yrs. 3.3 lb; Castrates 2/3 yrs 3.3 lb., 3 & over 4.7 lb.; Bulls 5.0 lb.; and Cows 4.5 lb.

Herd Value

Within a five-year period, the theoretical value of the breeding stock should rise with the effects of better young stock nutrition, disease control, and culling. An incremental herd value of shs. 1,758,918 is shown to indicate this increase. This same differential is projected for the second five-year period in calculation of cost benefit effects.

Sales

Cattle sales increase of 754 (46 percent) are projected for the first five-year period with a sale differential of shs. 135,640.

Recommendations - Komolonik

Survey

The first need is for thorough study and survey of the management practices, disease occurrences, herd composition, and production coefficients by areas within the Association. Survey information now being collected by the Kenya Range Development Program is excellent and could serve as a model for such an activity in Tanzania. This data could be collected and tabulated by university-level Masai students. Masai members should be first told why this information is necessary and that they will be a part of the effort to get such information, not as bystanders but in actually relating their observations and recommendations on the survey programs.

As the marketing and general reliability of the Association develops, the information on herd composition obtained by survey may eventually be used to arrive at a member's share of the financial responsibility but this step should be taken only with the concurrence of the members. Information on herd composition, production coefficients, etc., must be coded and kept confidential so as not to be used for taxation purposes. A sample survey form for obtaining desired information is shown in Appendix 1. *

Calf Management

The Association should be encouraged to emphasize reduction of calf mortality. This will involve concentrating upon (1) losses from diseases

* This form was modified from that designed and currently in use by V. Miles, UNDP Range Development Project, Kenya.

with emphasis upon (a) ECF control, (b) surveying internal parasitism; (2) increasing young calf nutrition involving increased milk production for the cow herd.

An area should be identified close to dips in Monduli Juu and set aside as a site for grazing management. This area then will be used as a reserve for cows by a cooperating Masai who will also be expected to dip regularly. Vaccination schedules should also be carefully followed. This project should include modifying calf management practices (water, shade, etc.) where feasible.

Mineral Supplementation

Applied research on trace element and major element supplementation should be initiated with the appropriate background information on water, mineral lick, and soil composition. This could be most effectively done at the pilot level at the Ardai Research Unit. Salt and mineral supplementation could then be introduced with co-operative herds in Komolonik. This will likely increase water requirements so care should be taken to introduce this in an area where water is adequate.

Feeding of Immatures

The Association should not engage in purchasing immatures from outside the ranch for feeding purposes. To bring cattle in from other areas may introduce disease and dilute management.

Investigations should be made, however, on the economic feasibility (cattle responses, etc.) of moving some light immatures (Association origin) into a heavier weight for the strong heavier-cattle market in Arusha-Moshi. Such a project should involve studies on forage preservation methods for dry season feeding including surface ensiling systems (ground packs), management requirements, etc. This must be regarded as a research project not as a demonstration.

The information gained on feed preservation or storage methods will apply to field projects with cow-calf improvement.

Breeding

Efforts and expenditures should be directed toward improving the "environmental" phase of cattle production.

Investments should not be made at this time in genetic identification, improvement, or proliferation (artificial insemination) schemes. With the limited capital available to the Government of Tanzania, it is unwise to divert monies from the critical areas of need to one which cannot be considered essential.

The Mpapwa station and NDC ranches should be the source of "improved" bulls when the need for improved stock becomes justified.

The use of Sahiwal bulls (or another adapting high lactating breed) may increase the milk supply when the situation justifies. This Zebu breed carries a relatively high lactation potential and could help increase needed lactation capacity if environmental requirements are met.

A few cows with high milking ability might be introduced and provided with better than average management and feed intake. The purpose would be to provide milk for domestic consumption to alleviate the milking pressure on the bulk of the cow herd.

This should be tried on a very limited pilot level basis in better areas with a few progressive Masai. It will require considerable "in the field" liaison between technical personnel and cooperators. At this point, however, it must be considered "strictly exploratory."

This should not confuse a dairy development plan with the sale of milk to outside markets. Such milk selling schemes have resulted in the increased demands for milk for sale, thereby actually increasing the problem of insufficient milk for calves.

DISEASE CONTROL AND RESEARCH

With the confinement of indigenous herds to defined areas, disease problems must be researched as early as possible. Masai have traditionally combated disease problems by moving cattle away from infected areas.

Diseases

In order to identify available information about disease problems, various representatives of the Veterinary Division and WHO (regarding human health) were consulted. The following is a summary of concerns considered to be important:

Cysticercus Bovis

The presence of *cysticercus bovis* in Masai cattle may lower performance, cause marked reduction in carcass value, and is a source of infection for humans eating meat not thoroughly cooked (a popular Masai custom). Infections in cattle apparently have some area pattern, according to Veterinary personnel consulted. Humans are involved in the transmission of the infective agents to cattle and human medical personnel interviewed feel that this matter could and should be dealt with effectively in the association areas where both cattle and human population movement is restricted.

Brucellosis

Abortion is a major problem in the cattle herds and occurs independent of specific pathogenic organisms. But brucellosis is one pathogenic agent responsible for cattle abortions and it also causes undulant fever in humans. Information on brucellosis titres would be particularly revealing at this time as practically no vaccination has been done in Masai herds, thus eliminating the position reactor resulting from adult animal vaccination.

Internal Parasite Infections

Particularly in young cattle, little has been done to determine the nature and rate of internal parasite infections in Masai cattle. Such infections can limit growth rates and can cause death losses. It is to be expected that the internal parasite infection rate will increase in young cattle with more intensive systems of cattle management under increased cattle concentration on the rangelands.

Game

The actual role of game animals as reservoirs of diseases (such as rinderpest) is very complex and involves many parts of East Africa. The research on this should be, and is being, conducted on a regional basis. This is included here merely to indicate a need by Tanzanian Veterinary personnel for research on the subject.

Fascioliasis

Research is needed to determine methods for controlling fluke infestation in certain areas. This occurs principally in Mbulu Division,

but there is considerable trading and movement of cattle between this area and Masailand. This results in economic losses through condemnation and lowered productivity of living stock.

Rhipicephalus Appendiculatus (ECF) Survey

With the relatively advanced development of the Komolonik area, a detailed survey of the presence of *Rhipicephalus appendiculatus*, the carrier of *Theileria parva*, should be considered. General survey work for this area has been reported by Yeoman and Walker (1967).

Trypanosomiasis

This does not appear to be a problem in the cattle at Komolonik. This is based on opinions by Veterinary personnel and on comments by Masai. There is little detailed survey information on Glossina occurrence in Komolonik.

Dipping Requirements and Costs

Dip locations in Komolonik are shown in Figure B. At present, East Coast Fever (ECF) occurrences are most frequently in Monduli Juu. The dips are located in this area with one being regularly used. Little use is made of the other dips located within the Association, and this has raised considerable concern on the part of the Ministry personnel about the reluctance of the Masai to avail themselves of these facilities.

From a disease control standpoint, it must be realized that dipping is not always a desirable practice, even though ticks are present on cattle. The presence of the *Rhipicephalus appendiculatus* tick with its potential for carrying the *Theileria* organisms justifies the dipping of cattle -- particularly young stock. Other tick species do not transmit this organism but do carry and transmit anaplasmosis and babesia organisms. Cattle may develop some tolerance to such organisms and this tolerance lessens where cattle are tick-free. Should reinfection occur, cattle may suffer more severely from such a challenge. Game coming in and out of areas are carriers and must be considered as infectious agents.

This is not to imply that increased productive performance could not be improved if tick loads were eliminated. To completely remove sources of infection of anaplasmosis and babesia as well as eliminating the effect of the tick itself would enhance performance of cattle.

The following data is in reference to costs of dip construction and operation:

Dipping Costs (Source, Veterinary Division, Monduli)

Construction (not using metal liner) Shs. 16,000

Filling and Maintenance of Dip:

Capacity 3,500 gal.

Concentration 300 p.p.m.

Cost of filling one dip Shs. 185.00

Cost one gal. toxaphene Shs. 34.60

Total Cost of Filling and Maintenance
for One Year:

Per 1000 head - 183 shs. x 2 (fill twice)	Shs.	366
51.9 x 52 (replenishment)		<u>2,698</u>
	Shs.	3,064

Per 2400 head - 183 shs. x 2	Shs.	366
51.9 x 2.4 x 52		<u>5,668</u>
	Shs.	6,034

Cost on 1000 head basis -- Shs. 2,350

Labor:

Dip Attendant at 138 per month Shs. 1,658

Laborer at 132 per month 1,632

Housing at 25/- per month (labor) 900

Miscellaneous equipment 200

Minor repairs 150

Transport (150 miles at 1/65) 247

Total Shs. 4,785,50

Total Annual Dip Costs per 2400 Head:

Construction Shs 16,000

SMS. 10,000
10 819 (6 034

annual (4 785

Shs. 26,819

$$10,819/2.4 = 4.5 \text{ Shs. per head/year}$$

Cost per head per year -- Shs. 4.5

Recommendations - Disease Control

1. Projects should be initiated to obtain basic disease incidence information on Komolonik Ranch and in other areas being considered for association development. It is not likely that the collection of such information could be thoroughly and effectively done by Range Commission personnel in view of their many existing responsibilities.

Surveys should be made under a special project type arrangement by the Veterinary Division and should include as priority areas:

a. Brucellosis;

b. Cysticercus bovis - it is possible that control of this disease could be most effectively approached by combining resources of veterinary and human disease control agencies such as WHO. This could demonstrate the role of an association in providing benefits to both the human and animal population that it supports.

c. Internal parasite infection rates - such projects require in-the-field supervision by professional veterinarians.

2. The Veterinary Division should get a headstart on the potential disease problems which can develop from greater concentrations of cattle and limited movement of Masai herds. Furthermore, this is the area in which Veterinary personnel are the authorities and this Division would be more effective by intensifying its activities in this, rather than to be concerned with the marketing of livestock (other than the disease control aspects).

3. All disease control projects should be completely understood by the Masai and should consider problems which might occur in infection-free populations should re-infection occur.

4. For effective East Coast Fever control (dip location, control of cattle movement, etc.) the patterns of Rhipicephalus appendiculatus occurrence should be known. Eventually, survey information on occurrence patterns should be obtained.

5. In areas that are known to be free from ECF infection, tick challenge should be maintained and the Masai should not be expected to dip regularly. This policy should be maintained until possibilities of outside reinfection are greatly reduced.

6. A dip should be considered in Komolonik at the edge of Ardai Plain in the area of coordinates 203 - 9631, Figure B, after discussion with association elders. This will allow the movement of cattle from the Monduli Juu to Ardai Plain as future marketing activities develop.

7. The Veterinary Division should coordinate permanent crush sites with the Range Commission.

GAME MANAGEMENT

The concern for game and domestic livestock co-existence has merited the attention of East African governments for a number of years. Recently the possibility of harvesting game for economic gain has been studied and pilot projects in game cropping are underway.

Co-existence

Game management personnel have seriously considered land use and controlled areas in their programming of game management and have prepared a Masai Wildlife Management Plan (Appendix III). Areas of normal game migration are detailed in this report. Reference is made to co-existence of livestock and game as well as statements that "livestock is almost entirely destructive." A thorough evaluation of game-livestock co-existence should be made, supported by research, to accurately plan the patterns of "co-existence."

Feed and Water Consumption

Game do consume dry-matter and water and this must be considered to be in competition with domestic livestock. Zebra and wildebeest, often found in large numbers on Masai ranges, consume water and dry matter at a rate similar to that of cattle. Data on water and dry forage consumption by game are shown below:

Daily Water and Forage Consumption of Wild Life *

	<u>Water</u>	<u>Hay</u>
Elephant	35-50 gal.	300-350
Rhino	12 gal.	50-60
Buffalo	10 gal.	30
Eland	8 gal.	25
Wildebeest	4-5 gal.	13
Zebra	6 gal.	15
Thomson's Gazelle	5 gal.	3

Game is a significant source of income and the Game Division does return up to 75 percent (300,000 shs.) of its fee receipts to local governments. Whereas income from licensing, trophy sale, etc. from game legally belongs to the state regardless of where the game is located, Game Division personnel feel that such funds from association areas would be re-

* Per Dr. H.F. Lamprey, Director, Serengeti Research Institute, Serengeti National Parks, received December 1968.

turned to the association. This source of revenue should be considered as a possibility to divert pressures from low market fee income for district councils. This can help take the burden of taxation from the market to increase market take-off of cattle.

Disease Transmission

Certain specific problems exist in game vs. cattle production. Game are reservoirs of certain diseases and parasites. Research is needed to determine what diseases actually are carried and to what extent such diseases actually are transmitted to livestock.

It is known that malignant catarrhal fever organisms are transmitted to pastures in the afterbirth of wildebeest at calving time. The Masai remove their cattle from grazing land where wildebeest calve for a month after calving has ceased.

Buffalo will carry *Rhipicephalus appendiculatus* ticks and appear to be the predominating game animal involved. Data from Yeoman and Walker (1967) show the following distribution (page 53).

Some game are primarily hosts for nymphs of this tick and do not carry significant adult populations. These two game-involved diseases appear to be the ones of primary concern to the Masai.

Specific areas requiring game management programs are Loliondo Division and possibly Komolonik. Considering the overgrazing by cattle which exists in Loliondo Division with its marketing problems, the presence of the herds of wildebeest, hartebeest, gazelle, and zebra constitute competition for grass. The wildebeest present a problem with the transmission of malignant catarrhal fever.

TABLE IV
DISTRIBUTION OF TICKS AMONG GAME ANIMALS

Host	No. of animals examined	No. of animals infested	Title			Total	Maximum single infestation (adults)		
			Male	Female	Adults		Nymphs	Larvae	
Ukamba Hare	14	6	-	-	-	40	-	-	-
Larger Cane Rat	2	1	-	2	2	-	-	-	2
White-tailed Mongoose	7	3	-	-	-	118	-	-	-
Leopard	7	1	1	-	1	-	-	-	1
Bush Pig	4	1	-	-	-	1	-	-	-
Buffalo	25	2	22	6	28	9	-	-	17
Bush Duiker	3	1	1	-	1	141	1	1	1
Defassa Waterbuck	1	1	5	6	11	-	-	-	11
Steinbok	4	2	-	1	1	173	-	-	1
Dikdik	13	6	-	-	-	172	-	-	-

Recommendations

1. When an association at Loliondo is formed, discussion should be held with the Game Division officials on a game reduction program there.
2. While the areas of Olmoti, Kijungu, and Komolonik did not appear to have heavy game population, talks should be held with Game Department officials to discuss a recommended approach to co-existence or game reduction. The fact that such associations are committed to obtaining higher cattle production warrants emphasizing cattle production.
3. Game Department people are concerned about improving game management and are quite cooperative. Discussions should be held between association representatives and these Game Department officials.
4. Field study of game vs. cattle production should be made prior to forming association policy on game control.
5. In association areas with the relatively limited acreages, emphasis should be placed on maximizing cattle production, particularly where the question of game vs. cattle production is concerned.

KOMOLONIK RANCHING AREA

ASSOCIATION FORMATION

Komolonik, covering 220,000 acres near Monduli, was chosen in 1964 for the pilot demonstration ranching association. Because this area includes three distinct physical regions, each having different range, water, and livestock production problems, organization problems are complicated:

- a. Arda (Figure B) - 5,900 acres with good range production capacity, but lacking good water storage structures. Water resource needs are a major concern in Arda.
- b. Monduli Juu (Figure B) - Region of highest elevation; 81,000 acres of high annual rainfall, steep slopes, and light soil. This section contains the forest reserve, has the heaviest cropping and supports the tick which transmits East Coast Fever. Thus many Masai in this section dip cattle regularly. Since some pasture remains green during the entire year, this has been used as dry season grazing for cattle from the other two regions. The death loss from ECF is the major concern in Monduli Juu.
- c. Mfereji (Figure B) - Low lying depression covering 80,000 acres; low rainfall area with evidence of over-grazing and some range deterioration. No evidence of East Coast Fever. This section has a pipeline system with six tanks which has encouraged trespassing around the western perimeter. Trespassing is a major concern in Mfereji.

The Range Commission felt that by initiating action in Masailand, they would prove that the GOT was really serious this time. They developed a detailed ranching scheme - spent over 1½ million shillings (\$210,000) on water developments, road construction, dipping vats; proposed personal stock quotas and a budget. A steering committee selected by the Masai was formed to pass on the scheme. Neither the budget nor stock quotas have been accepted although developments wholly financed by the Range Commission are being used.

While the Commission is attempting to complete registration, the ranch is deteriorating. For example, the rangeland along the pipeline in Mfereji is being abused due to overstocking conditions resulting from alleged trespassers. The Masai have not agreed to report trespassers other than cattle buyers and feel that neighboring kinsmen have a right to graze on the Association.

The Masai elected 10 members from each area to serve as a steering committee and act as a point of contact between Association members and the Range Commission. Meetings are conducted with these 30 leaders, who in turn take the word to the balance of the membership. This system has just one fault. It does not work. Communications between the membership and the Commission need to be improved. The move by the Range Commission to get the backing of the Masai through capital improvements has not succeeded. The Masai feel little responsibility for the improvements made, possibly because they were not involved enough in the planning and construction of the improvements. They definitely do not feel it was a partnership arrangement. Their attitude is that the government has done this much, let them finish the job.

The majority of the Masai have not perceived the need for an association nor how an association would work. They have difficulty in seeing how their needs will be solved by the scheme presented by the Range Commission. The Masai feel strongly that the government officials do not fully explain their proposals so that they can understand them. What they do not understand, they distrust and hesitate to commit themselves to support. The Masai have been suspicious of the Government and the Range Commission, primarily because they have not understood what the Commission and its officials are trying to do and why.

Getting the Masai to accept stock quotas and a budget were the two major problems holding up registration:

Stock Quotas

At the time a ranch is established the Commission must, by law, declare the number of stock units authorized for the ranch. This number may vary "provided that the number initially so declared, and the number as varied during the first three years succeeding the land becoming ranchland, shall not be less than the estimated authorized number included in the proposals approved for such ranchland."

In its by-laws, a ranching association must prescribe how many stock units each member can have. When the association also keeps or grazes stock on its ranchlands, it must also prescribe its own stock quota. However, no specific procedure for determining these quotas is recommended either in the Act or in the Regulations. Both the procedures for establishing individual stock quotas and the methods for reducing the number of units held by specific individuals will be tested at Komolonik.

The first problem in establishing stock quotas is to provide enough cattle to each individual to allow him to subsist. Thirty-five head is the number generally accepted in Masailand to provide a subsistence living, but 15 units is accepted as a reasonable starter.

The number of head now owned by individuals in Komolonik ranges from 0 to over 500. There are 193 individuals having less than 15 head each with 114 of them living in Monduli Juu, many of whom are cultivators. The cushion between the number of units now owned (20,500) and the number of units that can be carried on the range (23,000) can be used to bring the number of head owned by each member up to 15. Based on census data this will increase stock units by 1,544. Thus 1,000 stock units would be the remaining expansion potential after all members are at the 15 stock unit level.

The Monduli Juu area, with its heavy cropping, will receive a proportionately larger share of the expansion stock units under this scheme. This could bring objection from representatives of other areas.

The stock quota scheme must be thoroughly explained along with the stock unit system being used and why it will eventually have to be altered. Should the Masai persist in rejecting this, the alternative would be to have them present their own scheme, which should also allow for smaller livestock holders to get a starting workable number.

Alternative Operating Budgets

The Masai steering committee refused to accept the budget drawn up by the Range Commission when it was first presented to them (Budget A). They felt that the price they were being asked to pay was too high, especially since they were not involved in making the decisions. Also, they criticized being asked to pay for the operation of five dips (item 1) when in fact three dips have not been used and are not likely to be used in the near future.

At this point it should be made clear that the Komolonik Masai are not familiar with the complex budgeting required to run an association and such concepts as reserves are foreign to them. Characteristically, they sell cattle when they need funds.

Budget B - an "ideal" budget - shows what it would actually cost to finance completely the operation of Komolonik, plus paying for all the water developments and other improvements already made by the GOT. This budget provides for these capital improvements to be paid for at a 4 percent rate of interest, as recommended by the team. Payments for water improvements (138,000 shillings) would not begin until the fifth year, and would continue for 35 years.

By levying a 15 shilling annual membership fee and a 9 shilling per livestock unit (LU) annual grazing fee, plus other fees, the association can cover operating costs and build up a surplus for the first five years. This surplus will help pay for the costs of the water improvements which begin in the fifth year, but according to projections it will be exhausted in the tenth year. At this point fees will have to be increased in order to continue to cover the water development costs.

Since the Masai were not involved in the decision to make the existing improvements in Komolonik, it is unlikely that they will be willing to pay for them, and the GOT may have to assume these costs as a cost of developing a "model" association at a relatively rapid rate.

If it is decided that the Masai should only be expected to pay for operating costs plus those capital improvements they approve in advance -- for example, the additional water developments recommended by the team--then Budget C should be used. It charges only for additional water developments; the 1,330,000 shillings for completed water and dip developments would not be repaid by the Association. Operating expenses - veterinary supplies, office expenses, wages, etc. - are the same as in Budget B.

Without having to pay for the costs of existing water developments, membership, grazing and other fees can be set at the same rate as in Budget B, but with no need to increase revenues after the first ten years. In fact, it would be possible to start at a lower level - 6 shillings per L.U. grazing fee - and increase it to 9 shillings in the fifth year. However, this procedure would have to be thoroughly explained to the Masai elders.

If the Komolonik Masai continue to refuse one of these budgets, the Commission might require them to bear certain operating costs only and recommend that the remaining operating and capital costs be assumed by the GOT.

In this case, the Masai should be expected to pay for: (1) dipping, (2) vaccination, (3) a portion of the cost of maintenance and repair of water supplies, and (4) management. These services would require three shillings per L.U. from each member in addition to an annual (15 shillings) membership fee. However, the Masai must realize that eventually they will have to pay for new dam construction, even though this will be put off to enable them to realize the productivity of their herd first.

Komolonik Ranching Association Budget "A"

<u>Revenue</u>	<u>Shillings</u>
1. Annual membership fee at 15/= per member for 490 member.	7,350/-
2. Fees from non-members from stock at 10/- per L.U. & 1/- for use of water annual	15,807/-
- Cess from crops obtained by cultivators -	
(a) Beans -/70 per bag from 2,000 ac at 2 bags/ac ...	2,800/-
(b) Wheat at -/50 per bag from 1,000 ac at 4 bags/ac.	2,000/-
(c) Maize at -/20 per bag from 2,000 ac at 6 bags/ac.	2,400/-
3. Fees from forest produce (broad estimate)	2,000/-
4. Annual levey on members' stock at 5/- per L.U. (19,367 livestock units)	<u>96,835/-</u>
	129,192/- =====

Expenditure -- 106,255
"Surplus" -- 22,937

Budget "A" (cont.)

Budget "A" (cont.)

	<u>Shillings</u>
(b) Dips at 3% for 5 dips (80,000)	2,400/-
(Dams, roads and tracks are maintained annually - therefore, there is no depreciation.)	
7. Appropriation for development: Dam south - west of Tarosero ave. over 5 yr.	<u>12,000/-</u>
	106,255/-

Budget "B" (Shillings)

<u>Income</u>	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>Year 5</u>
Membership fees @ 15 shs/ member (490)	7,350	7,350	7,350	7,350	7,350
Grazing Fees - 20500 L.U. @ 9 shs./L.U.	184,500	184,500	184,500	184,500	184,500
Non-member fees	15,150				
Cash rent-Cultivators @ 2 shs./ acre	10,000	10,000	10,000	10,000	10,000
Fees from Forest Products	2,000	2,000	2,000	2,000	2,000
Marketing fees (members)			10,000	10,000	10,000
	219,000	203,850	213,850	213,850	213,850

Expenditure-Recurrent

Wages	18,000	18,000	18,000	18,000	18,000
Office Expense, Bookkeeping	400	400	400	400	400
Auditing	400	400	400	400	400
Dipping Expense	52,000	52,000	52,000	52,000	52,000
Vaccination @ .70 shs.	9,800	9,800	9,800	9,800	12,250
Maintenance - water supply	10,000	15,600	17,500	19,900	22,500
Machinery Hire	20,000	20,000	20,000	20,000	20,000
Miscellaneous	1,400	1,400	1,400	1,400	1,400
Depreciation - 5 dips @ 3%	2,400	2,400	2,400	2,400	2,400
Buildings	10,000	10,000	-	-	-
Roads	5,000	5,000	5,000	5,000	5,000
Water development	-	-	-	-	138,000*
	129,400	135,000	126,900	129,300	272,350
Reserve --	89,600	68,850	86,950	84,550	-58,500

* Includes capital costs of all water installations and 180,000 shs.
contingency expenditure year 4.

Budget "B" (Dollars)

<u>Income</u>	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>Year 5</u>
Membership fees	1,050	1,050	1,050	1,050	1,050
Grazing fees	26,357	26,357	26,357	26,357	26,357
Non-member fees	2,164	-	-	-	-
Cash rent - Cultivators	1,428	1,428	1,428	1,428	1,428
Fees from Forest Products	285.71	285.71	285.71	285.71	285.71
Marketing fees (members)	-	-	1,428	1,428	1,428
	\$31,285	\$29,121	\$30,550	\$30,550	\$30,550
 <u>Expenditure - Recurrent</u>					
Wages	2,571	2,571	2,571	2,571	2,571
Office Expense, Bookkeeping	57.14	57.14	57.14	57.14	57.14
Auditing	57.14	57.14	57.14	57.14	57.14
Dipping Expense	7,428	7,428	7,428	7,428	7,428
Vaccination	1,400	1,400	1,400	1,400	1,750
Maintenance - Water Supply	1,428	2,228	2,500	2,842	3,214
Machinery Hire	2,857	2,857	2,857	2,857	2,857
Miscellaneous	200	200	200	200	200
Depreciation	342.85	342.85	342.85	342.85	342.85
Water storage units	-	-	-	-	-
Buildings	1,428	1,428	-	-	-
Roads	714.28	714.28	714.28	714.28	714.28
Water development	-	-	-	-	19,714
	\$18,485	\$19,285	\$18,128	\$18,471	\$38,907
Reserve --	-	\$9,835	\$12,421	\$12,078	-\$8,357

Budget "C" (Shillings)

Capital Requirement of Initial Water Development
Prior to Registration Not Charged to Association

	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>Year 5</u>
<u>Income</u>	219,000	203,850	213,850	213,850	213,850
<u>Expenditure - Recurrent</u>					
Wages	18,000	18,000	18,000	18,000	18,000
Office Expense, Bookkeeping	400	400	400	400	400
Auditing	400	400	400	400	400
Dipping Expense	52,000	52,000	52,000	52,000	52,000
Vaccination	9,800	9,800	9,800	9,800	12,250
Maintenance - Water Supply	10,000	15,600	17,500	19,900	22,500
Machinery Hire	20,000	20,000	20,000	20,000	20,000
Miscellaneous	1,400	1,400	1,400	1,400	1,400
Depreciation	2,400	2,400	2,400	2,400	2,400
Water storage units	-	-	-	-	-
Buildings	10,000	10,000	-	-	-
Roads	5,000	5,000	5,000	5,000	5,000
Water development	-	-	-	-	<u>59,000</u>
	129,400	135,000	126,900	129,300	193,350
Reserve --	89,600	68,850	86,950	84,550	20,500

NOTE: No repayment on water development scheduled for year 1-4 inclusive. 4 percent interest compounded on debt, however, during this period. Debt retirement year 40.

Budget "C" (Dollars)

	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>Year 5</u>
<u>Income</u>	\$31,285	\$29,121	\$30,550	\$30,550	\$30,550
<u>Expenditure - Recurrent</u>					
Wages	2,571	2,571	2,571	2,571	2,571
Office Expense, Bookkeeping	57.14	57.14	57.14	57.14	57.14
Auditing	57.14	57.14	57.14	57.14	57.14
Dipping Expense	7,428	7,428	7,428	7,428	7,428
Vaccination	1,400	1,400	1,400	1,400	1,750
Maintenance - Water Supply	1,428	2,228	2,500	2,842	3,214
Machinery Hire	1,857	2,847	2,847	2,857	2,857
Miscellaneous	200	200	200	200	200
Depreciation	342.85	342.85	342.85	342.85	342.85
Water storage units	-	-	-	-	-
Buildings	1,428	1,428	-	-	-
Roads	714.28	714.28	714.28	714.28	714.28
Water development	-	-	-	-	<u>8,428</u>
	\$18,485	\$19,285	\$18,128	\$18,471	\$27,621
Reserve --	\$12,800	\$9,835	\$12,421	\$12,078	\$2,928

Credit Requirements

Making credit available to the Association is essential if it is to operate successfully. The present GOT policy is to make capital improvements as rapidly as possible on a priority basis, but the program is severely limited due to lack of ready cash. Certain major items like permanent water supplies could be expedited if the Association could obtain long-term loans at a reasonable rate of interest. The loans should be made on a long-term (40 years) basis at a rate not to exceed 4 percent interest per annum. Provisions should be included which would permit deferring payment up to five years. The funds and authority to make such loans could be given to the National Development Credit Agency. Then an agreement could be reached with the Association and its Bank for collecting the loan and no other security taken. Taking cattle for security would not be desirable since this could make it harder to obtain necessary credit for operating purposes.

Credit to enable individual members to purchase capital goods and to cover operating expenses should be made readily available. It may be necessary for members of the Association to buy cattle in order to increase their herds. Others will need funds for recurring annual operating expenses. In addition, funds may be needed for living costs and emergencies.

Recognizing the need for this type of financial assistance, the GOT has implemented a credit program for cash crops through the National Development Credit Agency. Further funds and authority would be needed to accommodate the needs of cattlemen. This credit should be made available at terms and rates conducive to improved livestock production - 12 years for repayment with interest rates not to exceed 4 percent per annum. All loans for annually recurring expenses should be scheduled for repayment no later than the first income or 18 months.

Due to the expected demand from the newly formed associations and the existing demand from the established cash crop cultivators, it would not be practical to set up sufficient machinery to handle these loans on an individual basis. Therefore, we recommend that the credit be made available to the Associations. They would be responsible for determining loan feasibility and for approving, servicing and collecting all loans made -- both chattel and long-term development. Provisions could be made in the by-laws which would permit the association to seize stock for payment of defaulting accounts.

Assistance from outside management/technical personnel will be required until the members become thoroughly familiar with the program. This assistance could be provided by a competent manager or outside personnel provided for the purpose.

Cost Benefits

The financial benefits of forming the Association were analyzed from the Government's standpoint; thus all costs for management and physical improvements (dams, dips, etc.) were included regardless of the source of financing. Value of cattle sales and accumulated herd value, earnings from sale of forest products and from cropping fees, are considered as benefits. The latter are justified on the basis that they are an income resulting from some association development costs.

The internal rate of return was developed at a discount rate of 7 percent in order to evaluate the development of this ranching association with regard to commercial rates for money.

If the costs and returns are based on a five-year projection, a negative rate of return results. This is to be expected, particularly in view of the heavy capitalization in water development and in the normal lag which exists in improving herd productivity and earnings.

Therefore, a ten-year projection was made, based on an incremental herd value similar to that in the first five years and an increase in sales value equal to that shown in the first five years. On this basis the internal rate of return is 8 percent with a cost/benefit ratio of 1.07 at 7 percent rate of interest.

Drought Loss Value

On a long range basis, the internal rate of return is also influenced by a reduction in death losses from extreme drought. These droughts occur on an average ten-year cycle. Estimates of losses in cattle deaths ranged from 50 to 90 percent in Masai District during the severe droughts of 1961. Further damage is felt in the loss of productive breeding stock and in the period required for recovery to normal productive capacity. However, recommended improvements provide water supplies which will enable cattle to withstand severe drought conditions.

The Masai estimate a 50 percent death loss at Komolonik in the 1961 drought. If this is reduced to 20 percent by virtue of the water developments, it would be equivalent to a herd of approximately 2,508,429 shillings (using projected herd incremental values) or an average 250,000 shillings per year. This is a highly variable and impredicatable factor and therefore is presented separately as an additional benefit.

Komolonik Ranching Association

<u>Year</u>	<u>Costs</u>	<u>Returns</u>	<u>Net</u>
0	1,442,000	0	-1,442,000
1	442,600	94,300	348,300
2	324,500	82,300	242,200
3	366,900	449,500	82,600
4	389,500	537,218	147,718
5	131,950	1,146,075	1,014,125
6	126,950	511,475	384,525
7	126,950	526,875	405,925
8	126,950	542,275	415,315
9	126,950	557,675	430,725
10	126,950	573,075	446,125

Internal Rate of Return 8.0%

Benefit/Cost Ratio @ 7% 1.07

Costs years 6 - 10 estimated as similar to year 5.

Incremental herd value allocated 1/6 year 3, 1/3 year 4, remainder year 5.

Incremental herd value estimated at 350,000 shs. per year 6 to 10.

Recommendations

Communications should be established with the Masai and trust developed between the Range Commission and the people in the area.

This means that the officials of the Range Commission will have to spend an immense amount of time in the field in direct contact with the Masai. The person doing the field work -- the Commission Secretary or the Range Management Officer or both -- should meet with the elders council (engigwana) every time it meets. In the beginning they should try to be in each of the three areas at the same place the same day each week.

At least a full half-day should be spent there each time. Whoever is in the field must tell the same story as the person before him. The officer in the field should not make any commitments without authorization. But once a position has been taken, the other officials should support him and make every effort to not contradict him.

The procedure for registration should be revised. Discussions with the Masai should identify problems they feel are most pressing and what they (the Masai) can do to solve them. All meetings with the Masai should be held out in the area -- not in Monduli.

The benefits of an association and how it works should be explained to them during one of the meetings. They should be convinced that an association is one way of solving some of their problems but that the decision to have one is theirs. No pressure should be put on them to form an association. The right to occupy their land and the right that goes with registration to control trespassers should appeal to them. No further capital improvements should be made until there is a commitment from the elders council as to what the Masai are going to contribute. If the Masai contribution is to be cash, no work should be done until the cash is received.

The requirements of forming an association should be explained in detail. If another livestock census is needed, the Masai should do it. The total livestock units for the association should be fully explained, and the Masai should approve the system of determining individual quotas. The amount of money needed for the projects they want should be determined on a livestock basis and the Masai should decide how they are going to raise it. The Team recommends that the Range Commission conserve payment for maintenance the first year the association is formed. The association could pick up one-third of the maintenance cost in each of the three following years. The Masai should be helped to develop a budget for the association. It is recommended that the first year's budget be set at the absolute minimum.

Since the elders council is the only group that can make a decision binding on the whole Masai society, we recommend that the steering committee be absolved, with the two elders councils in the area being the point of contact. This is not to say that no other contact should be made with the Masai. The field worker should visit in the bomas often and should make particular efforts to contact opinion leaders.

It may be desirable to divide Komolonik into two associations -- one association for the Monduli Juu and Mfereji area and another association in the Arda area. This would leave only one elder council operating in each association. Each council could make the necessary commitments and take the action needed to form an association, which is the normal territorial pattern by which the Masai make all other decisions. However, if the Masai feel that one association is needed for three areas, it should remain that way.

After the council and other residents have decided they want to form an association and have met the requirements, a management committee should be formed. The membership should elect no more than 10 people to serve on the committee. They should be made to understand that good men should be selected since they will be making decisions affecting them all. The management committee should meet frequently with the elders councils and other groups. In fact, all members of the management committee should be on the council. The committee should select the association officers it feels are needed and fill the same from their ranks. If one association is formed for the three areas, each area should be permitted to form a committee with the power to decide on local projects, collect money, and start action on the project.

WATER DEVELOPMENT

Guiding principles of program development include:

1. Locate water points to facilitate regulation of grazing.
2. Select type of design to make maximum use of water without waste.
3. Give priority to establishing permanent water supplies at intervals of 6 to 10 miles (radius of travel 3 to 5 miles).
4. Provide water supplies of sufficient usable capacity to carry through prolonged drought periods.
5. Design structures for surface water storage so that flows of flood proportions will be retarded and discharged at a rate to minimize erosion of channels downstream.
6. Manage and treat watershed lands to provide better regulations of runoff and minimize production of sediment to water supply reservoirs downstream.
7. Consider influence of water supplies or lack of same, in areas contiguous to the Komolonik Ranching Association, as they affect the use of water facilities within the Association.

An attempt has been made to locate possible water sites on the basis that animals could be watered daily and that none should have to walk more than three miles from the boma to the water supply. Theoretically, sites would be no more than six miles apart and should have a year-round supply sufficient to accommodate 2,000 animals as well as furnish domestic water for the Masai living in that area. Consideration was also given to locating sites in close proximity to the best grazing land and, so far as possible, to avoid the necessity for animals to cross escarpments or other geographical obstacles for water.

Development By Areas

As indicated elsewhere in the report, Komolonik comprises three distinctive areas, Mfereji, Monduli Juu, and Ardai.

It is advantageous to identify water development by each area separately. Although at present there is some inter-relationships in the use of water between areas, in the future, it is intended that each area generally will operate independently. During prolonged drought, however, water needs must be met at any point within or adjacent to the Association where reserves are provided for such emergencies.

In this connection, it is necessary to consider nearby water development projects in the program of the Water Development and Irrigation Division of the Ministry of Lands, Settlement and Water Development. This is particularly significant where such projects will help alleviate the pressure on Komolonik installations from encroachment of non-member livestock.

The water requirements were estimated on the basis of carrying capacity of the lands to be grazed and at a rate of 5 Imperial gallons per livestock unit per day. This may appear high but it is intended to include water needs for domestic use, dips and for game and to allow for low population estimates.

In developing water resources, the control of "bilharzia" must be considered. Masai must be informed of this disease with a thorough program of education. In addition, humans and livestock must be prevented from entering the storage water reservoirs by fencing.

Mfereji Area

The principle permanent water supply, provided by the Mfereji pipeline was dedicated and put into service by President Julius K. Nyerere on September 10, 1968.

Supply It was designed on the basis of a sustained minimum flow of 3,600 G.P.H.* or some 86,400 G.P.D.*. The yield of the water source,

* G.P.H. = Imperial gallons per hour; G.P.D. = Imperial gallons per day.

A water point is needed for the cattle grazing in the 19,000 acres above the Matuginigi Escarpment. This can partially be met with a surface water supply by an earth fill dam recommended for construction at G2, Figure B. Tank No. 7 recommended above is also readily accessible to cattle grazing in the southernly portion of this 19,000 acre area, alleviating the travel down the steep escarpment to Tanks No. 2 and 3.

Additional dam sites for surface water supply were viewed in the field at L4, Figure B. Construction of the most suitable of these, as determined by the instrument surveys, will further disperse grazing away from Tanks 4 and 6, and serve the area near the N.W. boundary of the Association.

Small Animal Watering Points It is considered undesirable by Masai to have sheep and goats water from the same trough as mature cattle. It is recommended, therefore, that a standard design for watering small stock be developed and demonstrated, especially in the Mfereji area, with cooperation from the Masai to construct the standing area surrounding the trough.

Further dispersal of livestock will doubtlessly be required when one or more tanks are closed temporarily to allow resting of overgrazed areas and during drought periods.

Monduli Juu Area

Situation Existing water installations are shown in Figure B. These, plus the additional supplies recommended, are to serve 9,229 livestock units grazing 81,382 acres, and for domestic use, for dips, and for large numbers of wild animals. The travel distance to water points generally would not exceed 3 miles as shown by the circles.

Existing Installations

	<u>Depth</u>	<u>Capacity</u>	<u>Coordinates</u>
Royny Pipeline		10,000 G.P.D.	214 - 9643
Emairete:			
Seepage collection well		10,000 G.P.D.	210 - 9641
Earth Dam No. 1	7 ft.	4.0 million gal.	210 - 9641
Earth Dam No. 2	6 ft.	10.0 million gal.	210 - 9641
Endobasat Dam	14 ft.	9.7 million gal.	195 - 9638

gauged in 1966, varied from 270,000 G.P.D. in June to 83,000 G.P.D. in December. Rainfall at the Tarosero Estate Gauge, some 6 miles distant at similar elevation, for the period June-December 1966 was 240 mm. (9.6 inches) below the 12-year average, an indication that the flow is adequate and will probably be exceeded in most years. A further indication to that effect was obtained when a rating made on November 19, 1968, showed a flow of 245,000 G.P.D. near the end of the May-October dry season, considerably exceeding the flow gauged at a similar date in 1966. Note was also made that some 36,000 G.P.D. bypassed the intake box and disappeared in the stream bed 150 feet downstream.

Water Consumption The Mfereji pipeline with six 10,000 gallon storage tanks serves a grazing area of 60,896 acres plus 19,088 acres above the Matuginigi Escarpment. The estimated number of livestock units (5,623) presently grazing in this area, using water at an average rate of 5 Imperial G.P.D. each, requires a total of 28,115 G.P.D. The grazing capacity of this area permits no increase in the number of animal units on a sustained basis. The total available flow provides water also for domestic use, dips if required, and abundant numbers of wild animals.

This, then, is one of the permanent water supplies in the Komolonik Ranching Association area that can help carry a large number of cattle through drought periods, such as those experienced in 1940-41, 1960-61, and 1964-65.

Location and Management The spacing and location of the six storage tanks as shown on Tarosero map (Figure B), gives a travel distance of less than 3 miles generally, and should help to sustain the grazing capacity, determined in the development and management recommendations.

Recommended Additions It is recommended that a seventh tank of 10,000 gallons capacity be scheduled for installation in 1970-71, at the location in Figure B of coordinates 223 and 9648. A connection for this purpose was provided when the main system was constructed. It was noted on November 19, 1968, that there was an overflow at this Brake Pressure Tank of 14,000 G.P.H., more than ample to supply the designed flow of 390 G.P.H. to this tank.

The area of rough topography northwest of Tarosero Mountain is understood to be grazed mainly in the rainy season. Cattle obtain water at that time from numerous small depressions and temporary stream flow. The need is met to a large extent by the higher water content of the grass during that season.

The Tarosero Saddle Springs and the Tarosero Spring referenced No. 3 and No. 4, respectively, in Kametz Report (1962) were not found during our field investigations in this area in October 1968. Inquiry of local Masai produced no information as to the existence of springs in the Tarosero Mountain region. It is suggested, however, that a more comprehensive investigation be made beyond that possible at this time of other water sources when needed.

Recommended Additions

	<u>Depth</u>	<u>Capacity</u>	<u>Coordinates</u>
Emairete Dam & pipeline	20 ft.	43.5 million gal.	210-9641
Amei Dam	14 ft.	7.3 million gal.	204-9642

Reconnaissance in the Tarosero Saddle Area indicates a number of auxiliary sites, listed below, warranting further consideration for surface water supplies.

These are needed to reduce travel and relieve congestion at the principal permanent points. The estimates of capacity may be adjusted on selection of the most suitable site at each location, after detailed examination and instrument survey.

Auxiliary Sites (Figure B)

	<u>Depth</u>	<u>Capacity</u>	<u>Coordinates</u>
K4	14 ft.	7 million gal.	209 - 9643
K4	" "	" " "	208.6 - 9643.6
K4	" "	" " "	208.2 - 9643.5
I3	20 "	10 "	202.2 - 9645

Ardai Area

Situation The location of existing and proposed water facilities for 4,515 livestock units grazing 59,120 acres, including the Research and Demonstration Ranching area, is shown in Figure B.

This is the most accessible area, being adjacent to the Great North Road, but the most difficult for obtaining economical permanent water facilities.

Borehole Failures Three boreholes were drilled in 1967-68, none of which produced water. B.H. No. 36/67 at coordinates 196 and 9629, Figure B, was drilled to a depth of 575 ft. The log of borings shows a thin mantle of black soils and clay underlain by volcanic materials.

B.H. 36/67 at coordinates 209 and 9624, Figure B, was abandoned at a depth of 900 ft. with a soil profile similar to No. 36/67.

The third borehole NP. 802 at coordinates 212.5 - 9636 found no water at a depth of some 1,300 ft. The information is that boring will continue to Basement Rock for research purposes. Most of the boreholes in the Rift Volcanic Zone of the Masailand have been unsuccessful, according to the Kametz report previously referred to.

The only spring flow is piped to the Monduli settlement mainly for domestic use but with a supply to a cattle trough near coordinates 216 - 9635, Figure B. Some of the cattle grazing in the Arda Plains use this watering point.

Accordingly, the principal water supplies must be provided by surface water impoundments.

Existing Dams The Ardai Dam (coordinates 209 - 9622), constructed in 1945 with designed water depth of 13 feet, has silted to such an extent that less than half of the original capacity remains. The water surface is large in proportion to depth -- so much so that evaporation of some 68 inches per year leaves little reliable usable capacity.

Water was diverted from the Ardaí River to this watershed by a dam constructed in March 1968 at coordinates 206 - 9624, to augment the low runoff from the presently well grassed, low gradient catchment of the Ardaí Dam. The heavy rains April 1968 produced such high flows via the diversion that the Ardaí Dam spillway, 150 ft. wide, reportedly flowed 3 ft. deep overtaxing the culverts at the Great North Road, one-half mile downstream, and breached a small dam below the highway. It can be expected that increased sediments will be transported by the diversion into the Ardaí reservoir.

The Eluanata Dam (coordinates 197.4 - 9626), constructed about the same time as the Ardaí Dam, breached sometime prior to 1962 according to the Kametz report.

The reservoir had a large surface area of about 3 square miles but, because of an original maximum depth of only 5 ft., it usually dries up in the dry season.

A proposal to raise the existing dam to provide a deeper lake seems ill-advised because of the uncertainty of the present dam's stability. This is evidenced by the breaching referred to above and the presence of considerable seepage at the toe of the dam even with the existing low head of water. The raised dam would have even larger water surface area subject to high evaporation losses and continuance of the heavy swamp-like vegetation at the shallow perimeter.

Charco Dams Recently Constructed The location and capacity of the three charcos built in 1968 are:

<u>Location</u>	<u>Capacity</u>
209.5 - 9628	1,805,000 gallons (1,025,000 above drawoff pipe)
203.6 - 9623.2	1,500,000 gallons
194.9 - 9631	1,805,000 gallons (1,125,000 above drawoff pipe)

The charcos, as designed in Komolonik, present a problem of water utilization by livestock.

Only the top eight feet of the reservoir depth is available to the offtake outlet. Furthermore, the remaining water reserve is below the outside water trough level and thus siphoning would not be practical. The steep sloping sides of this dam construction prevent livestock from drinking directly from the dam itself.

Earth Dams, Ardaí Ranch Area The location and capacity of the two dams built in 1968 are:

<u>Location</u>	<u>Capacity</u>	<u>Depth *</u>
No. 1 - 209 - 9624.8	8,000,000 gallons	8 ft.
No. 2 - 210.5 - 9623.9	9,700,000 "	8 "

* These structures are relatively ineffective for dry season water needs due to the shallow depth.

Recommended Additions It is recommended that a new dam with Drop Inlet type principal spillway be constructed at a site downstream, but above the highway, where the abutting hill slopes are about 150 ft. apart. This would provide a deep storage with comparatively small surface area. The old Ardaí Dam should be maintained, as it will continue to trap sediment.

An alternate proposal is to consider a site less than a mile below the highway near the confluence of an easterly tributary. On the basis of a brief examination of this location in October 1968, it appears that large deep storage is obtainable with a capacity adequate to carry through a prolonged drought (coordinates 210.6 - 9620.7). This structure should also be of the Drop Inlet type.

An adjunct to either of the above proposals is the need for a "water storage structure in the Ardaí River point A." This should be of the Drop Inlet type with storage capacity to the elevation of the emergency spillway sufficient to retard high runoff. The reduction in peak flow obtained thereby will alleviate the hazard of erosion at the diversion dam and in the channel leading to the Ardaí reservoir at coordinates 209 - 9622. Even with this reduction, the channel referred to needs to be regraded to a wider saucer shape (parabolic) and grassed to reduce velocity. In addition, this storage with a cattle trough will help serve the area north of the demonstration ranch as well as the ranch itself, when its water supplies are low.

It is recommended that an earthfill dam be constructed to provide deep water storage at coordinates 197 - 9621.5, one and one-half

miles downstream from the Great North Road. This would replace the Emugur Engegobe Dam nearby, which breached during the high flood flow May 1968. Although the watershed is about 50 square miles, the Eluanata reservoir's effect on flood peaks necessarily would be considered in designing the new Emugur Engegobe Dam. This should be of the Drop Inlet type as recommended for the structure below the Ardaí Dam. The reduction in outflow obtained from this design, including a St. Anthony Falls (S.A.F.) type energy dissipator, is required to minimize channel erosion downstream. The axis of the dam should be some 200 feet upstream from the present dam, above the draw from the left bank, for locating the emergency spillway and providing access to a cattle trough below. This is a controlling consideration in most of the earthfill dams recommended in this area, probably also for Masailand in general.

The Eluanata Dam should be maintained for its silt storage and other values. Immediate needs are repairing the side spillway and providing the drainage to control the seepage previously mentioned.

A site at coordinates 203.4 - 9631.3 appears, from field reconnaissance, to offer the best possibility for a surface water supply to serve the area north of Olkaria. A higher sustained yield of water from the wooded headwaters of the 600-acre catchment is possible than in plains area. It is essential that the watershed lands be protected from fire and other misuse. As referred to later in this report, this is required for all watersheds. It is estimated that there should be a deep water storage of some 9 million gallons attainable at this site.

An alternate or supplemental site at 202.3 - 9631.6 should be considered if found necessary to complete the pattern of water supplies. A deep storage is possible here as indicated for the site at coordinates 203.4 - 9631.3, described in the preceding paragraph.

Due to the failure to find water at the Borehole No. N.P. 802 drilled in 1968, it is suggested that consideration be given to a surface water supply at a site at coordinates 212.3 - 9631.3. The watershed of about 4 square miles appears to have a fairly high erosion potential, consequent flash runoff and sediment production, but a more detailed study is warranted to determine this. The permeability of the foundation and cohesive properties of fill material may also be limiting factors.

Mention should be made of the earth dam at coordinates 211.2 - 9627.9 about 2 miles downstream from the site, coordinates 212.3 - 9631.3 of the preceding paragraph. It had a much larger catchment extending to

the summit of Monduli Mountain with higher flood runoff potential, which probably contributed to the breaching some years ago. Casual observation of the present condition of the structure did not seem to warrant repair or replacement. This assessment is supported by the decision made some years ago to rule out a proposal for an earth dam in the immediate vicinity on the basis of test holes, as reported in the Kametz report of September 1962 (Ololmoswa Dam Site).

Water Supplies for Recurrent Drought Conditions

One of the most important considerations in water development programs is the prevention of severe losses during extended droughts.

Analysis of the records of rainfall at six stations in the general region showed three distinct drought periods 1940-41, 1960-61, and 1964-65. The records at two stations covered a period of 37 years; two stations - 12 years; one station - 10 years; and one - 8 years.

Drought Periods

Rainfall Deficiency from Average (inches)

	<u>May '40 - Oct '41</u>	<u>May '60 - Sept '61</u>	<u>May '64 - Feb '66</u>	<u>Variable</u>
Selian Estate	14	22	21	22 mos.
Olmotonyi Forest Station	18.5	16.5	24	19 mos.
Tarosero Estates		19.5	12.5	19 mos.
Monduli		14	23	20 mos.
Loiborsoit		9	18	19 mos.

(See Appendix VI for drought information in milimeters)

The effect on surface water supplies due to low precipitation during drought periods is further influenced by the extent to which evaporation depletes their usable capacity. This is especially significant in reservoirs of shallow depth, most of which dry up, as pointed out for many of them in Arda.

Studies in Kenya of Potential Evaporation from Open Water by the East African Agriculture and Forest Research Organization (EAAFRO) provides a guide to the evaporation to be expected in the Komolonik Association Area.

The average of evaporation minus rainfall at the six stations for the three drought periods is 75.3 inches. A reasonable figure to use is 72 inches or 6 feet.

A reservoir with full capacity at the end of the rainy season would lose 6 feet of depth during a prolonged drought, not counting the draw-down from watering cattle and wild animals (see Page 51) and losses due to seepage and silting. (The Messorani Dam, 7 miles south on the Loiborsoit road silted to a depth of 8 feet from 1941 to 1961.) Since the largest amount of the water storage, by far, is in the upper part of the reservoir, loss of depth from causes cited is of critical importance in judging availability of supplies for watering during dry periods. Thus, during severe drought periods, cattle rely upon the amount of water which remains after the losses of evaporation, seepage, etc., have occurred. Observation indicates that too many surface water supplies fail to have water when it is most needed, due to shallow depth.

It is judged that two deepwater reservoirs are indispensable to carry cattle grazing the Ardaï area through drought periods.

One is needed as a replacement for the Emugur Engegobe Dam which had a depth of water of 45 feet. The specific location, upstream from the breached dam, must be determined by field topographic surveys, exploration of foundation and adjacent banks, and analysis of fill materials performed at the Soil Testing Laboratory at Dar es Salaam. These data would be used for designing the earth dam on the principles of Soil Mechanics, and consideration of the peak flows and yield expected from the watershed. As mentioned previously in this report, a structure of the Drop Inlet type is best suited for this purpose, utilizing the temporary storage of flood runoff to reduce discharge through the spillways.

The second deepwater reservoir would be located at coordinates 210.6 - 9620.7, some 9 miles east of Emugur Engegobe Dam, with the Ardaï Dam upstream providing sediment storage as well as a dampening effect on flood flow.

The data determined in the Loitoketok D.C. station at $2^{\circ}56'$ S. and $37^{\circ}31'$ E. altitude of 1980 M. (6,500 ft.) was considered to be applicable to Komolonik. The mean rates monthly are:

						Inches
<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>Apr.</u>	<u>May</u>	<u>June</u>	
6.75	6.2	6.4	5.3	5.1	4.6	
						= <u>TOTAL</u>
						68.5
<u>Jul.</u>	<u>Aug.</u>	<u>Sep.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>	
4.8	5.2	5.9	6.5	5.7	6.1	

Applying these rates to respective drought periods gives totals as follows:

	<u>Inches</u>	<u>Feet</u>
May '40 - Oct. '41 (18 months)	100.55	8.38
May '60 - Sep. '61 (17 months)	94.05	7.84
May '64 - Nov. '65 (19 months)	106.25	8.85
May '64 - Dec. '65 (20 months)	112.35	9.36
May '64 - Feb. '66 (22 months)	125.30	10.44

Surface Water Reservoirs
Evaporation minus Rainfall

Selian	$\frac{\text{May } '60 - \text{Sept. } '61}{94.1 - 19.8} = 71.7 \text{ in.}$	$\frac{\text{May } '64 - \text{Feb. } '66}{125.3 - 34.3} = 91 \text{ in.}$
Olmotonyi	$\frac{\text{May } '60 - \text{Oct. } '61}{100.5 - 27.2} = 73.3 \text{ in.}$	$\frac{\text{May } '64 - \text{Nov. } '65}{106.3 - 26.5} = 79.8 \text{ in.}$
Tarosero	$\frac{\text{May } '60 - \text{Sept. } '61}{94.1 - 21.1} = 73 \text{ in.}$	$\frac{\text{May } '64 - \text{Nov. } '65}{106.3 - 34.2} = 72.0 \text{ in.}$
Monduli	$\frac{\text{May } '60 - \text{Sept. } '61}{94.1 - 23.5} = 70.6 \text{ in.}$	$\frac{\text{May } '64 - \text{Dec. } '65}{112.4 - 25.1} = 87.3 \text{ in.}$
Arusha WD & ID	$\frac{\text{May } '60 - \text{Sept. } '61}{94.1 - 32.9} = 61.2 \text{ in.}$	$\frac{\text{May } '64 - \text{Dec. } '65}{112.4 - 35.9} = 76.5 \text{ in.}$
Loiborsoit	$\frac{\text{May } '60 - \text{Sept. } '61}{94.1 - 18.8} = 75.3 \text{ in.}$	$\frac{\text{May } '64 - \text{Nov. } '65}{106.2 - 12.7} = 93.5 \text{ in.}$

Other Water Development Plans Affecting Komolonik

The second 5-Year Development Plan 1969-74 of the Water Development and Irrigation Division of the Ministry of Lands, Settlement and Water Development contains several water supply proposals affecting the program of the Komolonik Ranching Association.

Of particular interest are:

1. The Kitumbeini Pipeline, 1970-71, the lower storage tank of which would be but 3 miles from the northwesterly boundary of Komolonik and within 10 miles of storage tank no. 6 of the Mfereji pipeline.
2. The Kidete Pipeline Extension, 1973-74, the nearest tank of which would be within 10 miles of the Endobasat Dam of Komolonik.
3. The Lenginaji (Engikaret) Borehole, about 16 miles northeast of the N.E. boundary of Komolonik.

These are shown in Figure A. Existing water points outside of Komolonik are also shown.

These facilities should help alleviate the problems of trespassing into water points of Komolonik, which has caused much concern recently. They would also help assure carry-over water supplies during drought periods for cattle outside.

Watershed Protection

This is discussed in the section on range management, erosion control.

Operation and Maintenance

Operation and maintenance of water facilities, roads, and other improvements should be a responsibility of the Association with technical guidance initially from the Regional Water Development and Irrigation Division.

gation Division. The latter has received an allotment of funds from a loan, provided by the Government of Sweden, to build a Central Repair Shop at Arusha, to be completed and equipped by mid-1969. Detailed working drawings for construction are at hand.

The Komolonik Ranching Association, and others as formed in the Masai District, should arrange to have servicing and repair of pumps, stationary engines, construction and transportation equipment performed at this shop. The Association budget should provide for allocation of funds annually in advance to Regional WD and ID for this service. Judging by the lack of timely maintenance of borehole equipment observed at Loliondo and other areas in Masailand, it would be advantageous to have their servicing performed at this Center.

As more associations are formed and as the number of boreholes and other installations increase, the volume of work may justify a separate central repair shop on the bases of economy and effective service. If so, it should be done.

A system of preventive maintenance, following a definite schedule and permitting a minimum loss of use of the facility is desired. It is recommended that a system similar to that used effectively in Kenya be considered. (See Appendix VI)

The Association should arrange for on-the-job training in operating and current servicing of engines, water tanks, troughs, dips, etc. The training should be given to selected individuals, preferably Masai, resident in the vicinity of the water facility. A case in point is the sudden stoppage of water flow into the tanks of Mfereji extending to several days. The cause: clogging of the screen on the intake box at the source. One of the Masai in Mfereji -- designated by them -- should have responsibility to examine the screen at regular intervals, especially immediately following heavy rains.

Recommended Additions

Priorities for development of water facilities are considered to be as follows:

<u>Location</u>	<u>Type of System</u>	<u>Coordinates</u>	<u>Estimated Cost</u> (shillings)
<u>F.Y. 1968-69</u>			
Ardai A.	Surface water storage dam	206.4 - 9628	60,000
B.	Surface water storage dam or alternate site	209.5 - 9621.9	100,000
C.	Surface water storage dam	210.6 - 9620.7	
		197 - 9621.5	100,000
Monduli Juu			
D.	Surface water storage-Amei Dam	204 - 9642	50,000
<u>F.Y. 1969-70</u>			
Ardai E.	Surface water storage dams	203.4 - 9631.3	40,000
Monduli Juu			
F.	Surface water storage - Emairette dam & pipeline	210 - 9641	100,000
Mfereji G.	Surface water storage dam	223.5 - 9655	50,000
<u>F.Y. 1970-71</u>			
Ardai H.	Surface water storage dam	212.3 - 9631.3	60,000
Monduli Juu			
I.	Surface water storage dam	202.2 - 9645	60,000
Mfereji J.	Tank no. 7	223 - 9648	120,000
<u>F.Y. 1971-72</u>			
Monduli Juu			
K.	Surface water storage dam, if required then	209 - 9643	
		208.6 - 9643.6	40,000
		208.2 - 9643.5	
Mfereji L.	Surface water storage dam Most suitable one of three suggested sites	206 - 9657	
		207 - 9659	40,000

RANGE MANAGEMENT

Burning

There is probably no range management practice that creates more controversy or heated arguments between livestock producers world-wide than the question of burning the range. We find Masailand is no exception. A few of the pros and cons are discussed below.

Tick Control

While it is undeniable that large numbers of ticks are destroyed by burning, the process is usually so spotted that large islands and pockets in a given area are left undisturbed. In Komolonik this dry season there are reservoirs of unburned areas in nearly every case of burning. When coupled with the possibility of reintroducing a large game population (for example, the gazelle almost immediately moves into a burn to graze the first green shoots,) this raises doubt that burning has much value in tick control.

Bush Control

Fire can help control annual weeds through seed destruction as well as through controlling young and sprouting members of the acacia family. It is not effective in controlling most noxious type shrubs such as Solanum incanum unless followed in about six weeks by hand cutting of the unburned stalks and regrowth. A second cutting of regrowth at the close of the rainy season may be necessary in some cases. This plant appears profusely throughout Monduli Juu around old bomas, stock driveways, and wherever there has been range abuse.

An alternative procedure would be to investigate the cost and efficiency of applying herbicides to control this and similar range invaders.

Effects on Specie Composition

There is some indication that Themeda triandra can compete more effectively against the invasion of undesirable grasses and shrubs under annual burning. We do not accept this as fact until research has been carried out to determine the degree of beneficial effect to the total range complex.

Effect on Palatable Shrubs

Burning can permanently destroy palatable shrubs. This is undeniably true of many of the leguminous shrubs and plants on the demonstration area of the ranch which has been protected from burning for three years. This is also true towards the northern edge of Mfereji and that slope of Tarosero, where there is appearing a good population of Maerua crassifolia. This plant is high in protein, palatable and highly desirable on soils and topography of this nature. It is easily destroyed by burning.

Onset of Greening

Burning an area does not produce more green grass. It merely makes the regrowth more apparent and readily attainable. Rather than burning it would appear that the same purposes could be served by close grazing an area and then reserving the regrowth for young stock.

Erosion

Perhaps the most convincing argument against burning is that it destroys plant litter which if permitted to remain on the soil would enhance water percolation into the soil and inhibit erosion by controlling rapid runoff in heavy downpours. It is patent that burning has made a significant contribution to the problem of silting which has all but removed the usefulness of Ardai dams and Lake Eluanata Hanja as year-round water sites.

Recommendations

The Ranching Association should by regulation prohibit burning except by permit, and then only under the supervision of a range assistant.

Brush Conditions observed on the Ranch do not warrant the use of mechanical methods (tractors, chains or brush mowers) of brush control or the application of herbicides by airplane at this time. In this case, the Masai can participate in a "self-help" project by cutting bush in areas designated by the range officer. The prospect of salvaging some of the woody material by making charcoal should be investigated.

A program should be initiated to study the cost and efficiency of applying herbicides by back-pack sprayer to control the Solanum plant in Monduli Juu section.

Experimental work should be done to determine the cost of destroying Pennisetum straninium by herbicides and reseeding with a more palatable grass. If the reason for intrusion of this specie is that the land is under water during the wet season and if chemical destruction and reseeding should be found to be economically feasible, consideration should be given to the use of a replacement grass such as Panicum purpurascens (Raddi).

Range Erosion

One needs only to drive a short distance from Monduli towards the Ranch to observe the devastation that erosion has already created on several hundred acres of previously productive rangeland. This occurred as a result of mechanical destruction of plant cover by animal hoofs in many trips to and from water at Monduli over the same route. Other areas are eroded from a variety of preventable causes throughout the ranch range lands. As pointed out elsewhere in this report, tremendous erosion will develop along the stock water route to Tank Two and those north of that point, unless immediate steps are taken to decrease the number of animals watering there. The Association should immediately take steps to check present erosion and to prevent its occurrence in new areas. If corrective measures are not instituted, newly developed water sites will be destroyed in the same manner as Arda Dam and Lake Eluanata Hanja and the carrying capacity of the Ranch grasslands will be drastically reduced.

Recommendations

1. Replanting Much of the eroded land can be partially reclaimed through conservation measures. Both at Ardai and Tengeru Leucaena glauca quickly becomes established and grows quite rapidly. This plant is grown in many countries to control gully erosion and as additional livestock feed and protein supplement during the dry season.

The Range Management Officer should provide for the propagation of several thousand of these seedlings in plastic containers. Seeding should be timed so that the plants would be ready for transplanting by May 1970. After smoothing the sides of the gully, a series of three rows, one meter apart with plants spaced one meter apart in the rows, should be planted at 20-meter intervals at right angles to the direction of waterflow. The young plants will need to be protected from grazing and trampling the first year, possibly by covering the rows with thorns. After the November rains in 1970 the intervals between the series of rows should be sprigged with Cynodon dactylon. By the end of the rainy season in 1971 both the grass and shrubs should be able to withstand reasonable grazing pressure.

The Masai should be encouraged through education to avoid, as far as possible, traveling the same route each time in taking cattle to and from water. Erosion problems along cattle paths will increase as bomas become more permanently located - a circumstance that will inevitably occur as permanent watering points become more available.

2. Boma site selection From the standpoint of animal and human health, boma sites should be selected where there is good natural drainage. Locations where the gradient is sufficient to promote erosion should be avoided. Even with the most careful boma site selection, however, the constant passing of large numbers of animals is going to eventually create erosion problems. The only possible answer at present is to establish a network of holding kralls away from the boma site. All animals other than the milking cows and calves could be kept in these at night for short periods of time and then rotated to another krall, thereby relieving much of the pressure on the home boma.

3. Watershed protection Reference has been made to the need for minimizing the rate of silting into surface water supplies -- dams, charcos, waterholes. Although it was not possible during this assignment to study the respective watersheds in detail, our observations suggest the following:

a. Burning control This is the most generally applicable erosion control measure which will, at low cost, have far reaching results in preventing sheet erosion.

b. Channel construction Minor gullying is controlled by grading a channel of a cross section of sufficient width and gradient to carry runoff at non-erosive velocities. This is especially significant since the soil materials eroded from gullies and stream banks are carried directly and rapidly into reservoirs - a major source of sedimentation. Channels should be seeded with grass immediately following the grading.

c. Earth dams Control of larger gullies and channel erosion, both high contributors of sediment, will be accomplished by use of the drop inlet type of design in earth dams as described in the water development section of this report.

d. Control of erosion in cultivated areas In areas determined suitable for cultivation, contour cultivation, terracing with grass waterways and appropriate crop rotation systems should be required.

Physical Improvements

Internal Roads

For efficient functioning of the ranching operation, no additional roads are needed by the Association at this stage of the development. Resources can be better directed to other needs outlined in the report.

If access to the Arusha-Dodoma road proves difficult during the wet season consideration should be given to its improvement. It is felt that access to the demonstration ranch and Mfereji is possible, even during the rainy season, via the Great North Road and the Nairobi road, respectively. The team considers it highly desirable that the road, passable in all seasons by Land Rover, be maintained from Monduli through Monduli Juu to Mfereji furrow.

Since the need for both these roads falls largely in the category of convenience to the Government in conducting its business, construction costs could also be borne by the Government.

Diversion turn-outs at frequent intervals are needed on the recently graded road to prevent the accumulation of erosion proportions. This can be undertaken by the Masai, due to the slippery-when-wet nature of the roadbed on the steep gradients, some surfacing with metalling materials is required.

Stock Routes

Stock routes now in use are considered adequate for the current needs of the Association.

Fencing

The team can see no necessity for additional fencing to regulate movements of members' livestock as long as the practice of herding remains. Fencing of some kind should be provided around water reservoirs. Neither livestock nor people should enter the reservoir water.

Fire Breaks

Komolonik is unique compared to other areas observed in that it has a large number of natural fire breaks. But, whether the barriers are natural or artificial, fires will not be adequately controlled until the Association members stop their practice of burning.

Recommendations

An extensive system of fire breaks is not economically warranted nor would it be effective in preventing burning of the range. Instead of constructing a complete network of fire breaks, we recommend that an intensive educational campaign be launched through the Ranch Steering Committee to inform members of the damage being done to their range by the extensive burning now being carried out. Elders should be solicited to police their own areas and perhaps groups of Morani could be organized into fire fighting cadres. It is significant that no fires were observed in the Monduli National Forest Reserve this season.

There are some exceptions where the cost of constructing and maintaining fire breaks on the Ranch would be warranted. Because of the danger of persons other than members starting fires or travelers discarding cigarettes along the Arusha-Dodoma or Arusha-Moshi roads, the presently fenced area of the Ranch should be surrounded by a fire break. Also a break should be constructed along the road from Ardaai Dam to the Escarpment below Lake Eluanata Hanja. We recommend the clean cultivation (preferably by a tandem disc) of two strips at least 5 feet wide and 10 feet apart. The undisturbed center should be burned by Ranch personnel at the proper time to insure complete destruction of flammable material.

If the proposed forest reserve is established and remains ungrazed for several seasons, a tremendous quantity of fire material may accumulate. A fire occurring under such circumstances could destroy the entire timber resource. For this reason and also to serve as a clear demarcation line of the area, a fire break should encircle the reserve. Because of the nature of the terrain much of this will need to be done by hand and may be quite costly. It cannot be too strongly emphasized that this strip must be wide enough to be effective regardless of cost. A cleared area 15 feet in width should be a minimum.

Land Use - Cropping

The team commends the action of the Association in notifying all cultivators in Ardaai that their cropping activities must cease in 1970. The long-run economic returns to the country will be greater through utilizing the rangeland for the production of livestock. The fact that the two practices - livestock production and occasional cropping - are not compatible on Ardaai has already been demonstrated by the extensive erosion and dam silting which has occurred in the past.

Because of its higher rainfall and possibly better soils, the team recommends that a soil and land use reconnaissance survey be conducted in Monduli Juu. The survey should map out areas where cropping might provide greater returns than grass. No expansion of the present cultivation areas should be considered until the results of such a survey are available. Such lands could be used for high-producing forage legumes as well as crops.

Because of its geography and climate no crop cultivation should be authorized in Mfereji.

The cropping referred to in this section is commercial and not the cultivation of small plots or shambas by boma families for their domestic food supply.

Carrying Capacity

The ranch covers an estimated 220,000 acres.. Approximately 20,000 acres of this is established as forest reserve -- an area which also may be considered as a grazing reserve. The technical committee has established a ceiling of 23,000 livestock units for this area which represents a stocking rate of approximately 9.5 acres per livestock unit. This figure appears compatible with the usual stocking rates within the area for similar range and those established under like conditions in Kenya Masailand. However, an examination of the current estimated cattle population of the three Ranch areas indicates the need for some adjustment between the areas. A description of the conditions found in each of these areas follows:

Ardai Plains

This area, lying between the Arusha-Dodoma road and the Monduli Juu Escarpment, contains an estimated 59,000 acres. The present L.U. stocking rate is estimated at 5,700 including 1,150 L.U. of non-members living near Monduli and grazing on Association lands. A reconnaissance survey by Mr. E. G. Van Voorthuizen of the 1,000-acre portion set aside for experimental purposes indicates a population of perennial grasses of 60 percent plus 19 percent annuals. Predominant species are Digitaria scalarum 35 percent and Cyndon dactylon 23.5 percent. Superficial examination of the remaining area indicates that ground cover and species composition would remain quite uniform. Parts of this area have been undergrazed for several years because of inadequate water distribution.

Recommendations

Assuming that year-round water sites will be located and developed promptly, an increase of 600 resident livestock units could be supported.

Monduli Juu

This, the middle section of the Ranch, contains approximately 81,000 acres. Because of the high annual rainfall, steep slopes, and light soil, the danger of erosion is probably the most acute in this sector. The proposed Ranch forest reserve as well as extensive areas of brush and steeply eroded gullies of limited grazing potential are found in this section.

Grass species and amount of ground cover is similar to that of Ardai, except that at 5,000 feet Themeda triandra -- a grass of high grazing value -- tends to dominate the range.

This dry season has not witnessed the usual migration of grazing animals from the Mfereji sector to Monduli Juu. Since the establishment of the Mfereji pipeline, it is not likely that such grazing migrations will occur in the future unless there is a complete failure of grass growth in the Mfereji sector during extreme drought.

Recommendations

Assuming the development of year-round watering sites, the present estimated resident stocking load of 9,200 livestock units is appropriate.

Mfereji

This sector contains approximately 80,000 acres and a reported resident population of 5,600 livestock units. From September to December 1968 it has been under extremely severe grazing pressure. Accurate counts could not be made but close observation indicated that considerably more than 5,600 livestock units were using the six watering facilities of the Mfereji pipeline during this period. This belief is substantiated by the relatively few animals observed watering that bore the Association brand KR, by the fact that the tanks were at times being used as much as 12 hours per day, and because animals were being watered on an every-other-day basis.

This degree of overstocking is expected to diminish with the advent of the rainy season, but damage to the range in the two dry seasons that the pipeline has been in operation has been extensive. If this degree of grazing is continued unabated for another five years, most of the palatable vegetation north of Tank Number Two and lying west of the Matuginigi escarpment could be destroyed.

With the assistance of Mr. van Voorthuizen 1/ and his Tanzanian associates, detailed examination was made of the ecology at four sites in the critical area. At map coordinates 9650 - 221, 46 percent palatable perennial grasses were found and 54 percent not covered by growing vegetation at this season of the year. At map coordinates 9654 - 220, 40 percent perennial grass and 60 percent without vegetative cover was counted. Map coordinates 9657 - 218 revealed 65 percent devoid of live growth with 35 percent perennials. Of this last figure 17 percent was Pennisetum straminium which is not palatable to live-stock and usually appears as an undesirable plant associated with range abuse of some nature. At map coordinates 9662 - 211 readings indicated 23 percent perennials and 77 percent devoid of vegetation.

While these samplings are too limited to be conclusive, they are indicative of declining range forage values as one proceeds from Tank Number Two towards the northern boundary of the ranch. Variation in soil types and in amount of rainfall should not be significant in this short distance. It must be concluded that overgrazing plus the constant movement of large numbers of animals to and from water is rapidly denuding the light sandy soil of this area of palatable range forage species.

Recommendations

Resident livestock units for the Mfereji sector should be reduced to a maximum of 5,000.

Immediate steps should be taken to insure that only livestock owned by resident Association members are permitted to use this area.

Year-round supplementary water sites should be developed as rapidly as possible, and when installed, consideration should be given to completely closing Tanks Three and Six on alternate years with Tanks Four and Five. By so doing, boma owners would still be able to get domestic water, but stock might have to travel a greater distance from the boma to water. The rejuvenation of the range through complete rest for a year would benefit more than the inconvenience of greater travel for livestock.

Wildlife Effects

It has been difficult in the short time available to completely evaluate the impact of wildlife in establishing livestock stocking levels. There is some indication that with the construction of well dispersed permanent water sites there has been an increase in the resident game supply. Game is plentiful throughout the Ranch and may

1/ USAID Range Research Specialist.

possibly increase in numbers with migration to the area during the wet season. No information was found, however, that would indicate a disruption of the proposed stocking rates on any area of the Ranch by big game.

General Recommendations

The maximum stocking goal of 23,000 L.U. as set by the advisory committee for the Association is sound, at least until trends in grass species population indicate the need for revisions or until new range management practices are adopted.

The stocking rates proposed for the three sectors of the Ranch total only 20,500 livestock units. This approximates the present numbers of livestock owned by members and non-members. But with improvements in range management and provision of additional water supplies as suggested elsewhere in this report, plus the planned retirement to grass in 1970 of 5,000 acres in Ardai presently under cultivation, carrying capacity can easily be brought up to the 23,000 livestock units originally suggested.

Ardai Demonstration Ranch

The Ardai Demonstration Ranch was conceived as a means of introducing change to the Komolonik Masai by demonstration. It is located in the south-eastern section of Ardai as shown in Figure B. This area is being fenced and contains a functional dip. Forage plots are being grown and a specific forage research program is underway.

This unit will not be an effective instrument for inducing change in the Association. A major reason is the lack of relation which exists between this unit and the boma environment. This is particularly true in the case of Monduli Juu and Mfereji, which differ greatly in physiography.

Another problem lies in the physical plant. It will be very difficult to develop a year-round water supply in the paddocks, particularly one which will provide water during drought conditions. The presence of the fence creates the impression that this unit will be self-sufficient and if water resources are inadequate, the failure of the confinement principle will be obvious to the Masai.

Recommendations

Instead of a demonstration ranch, this unit should be utilized for applied research studies. A research program has been outlined and is being initiated. It is recommended that the following problems be researched here:

burning - frequency, time, etc.,
grazing tolerance of species and combined tick control,
feed preservation methods,
mineral supplementation - where water is available.

An additional 1,000 acres should be ear-marked for future forage research requirements.

There are several options for use of the remaining section.

One consideration is to use the fencing, dip, and crush facilities for an assembling and holding ground for market livestock from the Association. This would allow for branding, dipping, vaccinating, and quarantining. Should the Association develop to the point that a weigh-bridge is justified, it could be located here. This idea should be thoroughly discussed with Masai prior to any action being taken.

It must be considered that market cattle might contaminate cattle on research trials in other sections of this unit.

Another alternative is to study the economics and input requirement of feeding light immature cattle into the heavier fatter types for the strong Arusha-Moshi market. This could be associated with studies of feed preservation systems.

NEW ASSOCIATION AREAS

The Komolonik area has been stalled up to this point in its drive for association registration. It is recommended, therefore, that emphasis on association formation be shifted from total concentration on Komolonik to equal emphasis on the other areas where interest is high, Kijungu, Loliondo and Olmoti. Also, once a successful operation is underway, other areas will be more receptive to the ranching concept.

The most pressing need, in the eyes of the Masai, should be identified and the association formed around the solution of this need. One project should be started at a time and later more projects added as the first projects are well under control. For instance, in Kijungu the installation and operation of dipping tanks should be the first project. Water and other disease control could follow.

We strongly recommend simplifying registration procedures. An association should be registered when the following conditions are met:

- a. A list of all livestock holders and the number of animals held by each is compiled and submitted to the Range Commission office.
- b. The general area covered by the proposed association is marked on a map.
- c. Sixty percent of the Masai within the outlined area sign a request for association formation.
- d. The proposed members sign a statement designating the proposed total animal units for the area and the date when livestock numbers will be within this number.
- e. The total quota proposed is approved by the Range Commission.
- f. Association by-laws are filed with the Range Commission.

To delay the formation of ranching associations because a total development plan or operation details are lacking will only dampen existing enthusiasm.

KIJUNGU

Interested Masai have proposed to develop an association in southern Masailand at Kijungu (see Figure A), but action awaits decisions about several technical matters (size, boundary) by Range Commission personnel in Monduli. The area (Figure C) includes 300,000 acres, an estimated 12,000 livestock units and approximately 260 families. Team study of this area indicated problems of disease control, water development, and brush control. The range is clearly understocked.

Livestock Production

East Coast Fever is prevalent, causing very high calf losses. The Masai feel very strongly that this is their number one problem and have expressed a keen interest in installing dipping vats in the area.

Having medical supplies, dipping fluids, etc., regularly available is also important. A general association store if created could stockpile these supplies.

Water Development

A plan for increasing water supplies, their number two need, has been developed by the Ministry of Lands Settlement and Water Development. It will provide permanent water for both cattle and domestic uses. The Lolera pipeline and the Okitikiti dam supply water to both the northern and southern extremes of the area. Developing water supplies in the plains area east of Kijungu is the next priority, and a potential borehole site has been located (Figure C). In general, the proposed Kijungu association area has excellent potential for full water development.

Brush Control

Removing brush is a major way to improve range productivity although the Masai will probably not view this as a pressing need because the range is understocked now. In the sector observed, neither mechanical equipment nor herbicides would be required to eliminate the existing brush; Masai could control it over a period of time by hand cutting, initiated around the existing water sites and expanded. When water and range is completely developed an estimated total of 25,000 livestock units could be supported within the Kijungu association.

Before forming this association a satisfactory agreement should be arranged between the Masai and the Swahili-speaking farmers who live in Kijungu but who farm about 300 acres in the area. Although these farmers have expressed a desire to be included in the association, it would be wiser initially to omit a restricted farming section.

The Masai would like to register the association before installing dips or developing water since they feel that once these improvements are made, many people will immigrate in from surrounding areas. Without registration, there is no legal means of controlling the movement of cattle into the area.

Recommendations

Registration of this area should hinge around developing dips, establishing stock quotas and making the basic minimum financial arrangements to pay for effective operation of the dips. Minor technical problems may occur as registration proceeds, but only the minimum details should be required at first in order to proceed with the matters important to these people. The Masai should be expected to pay for the benefits that they receive and should be made to understand their responsibilities in turn for the government assistance. Functions which the association itself assumes should be kept simple and effective at the outset with correspondingly simple and minimal but sound technical and financial inputs. It is essential that the basic procedures recommended or required by the Range Act be followed for registration. This will include (a) a list of prospective members and their stock holdings; (b) individual member stock quotas; and (c) a simple budget for the first year, listing the estimated income and expenditures.

Murran interested in forming marketing groups should be encouraged and discussions held and visits made with TPC and veterinary personnel. Construction of a treating and quarantine holding area may be required.

LOLIONDO

The Loliondo District covers approximately 300,000 acres of north Tanzania Masailand (Figure A). There is considerable variation in rainfall and forage cover; there are areas of semi-arid plains and areas of rain forest. Most of these Masai have developed yearly migration patterns in order to utilize the dryer plains during the rainy season and save the

forage in the areas of higher rainfall for dry season grazing. Figure E shows normal rainfall patterns and traditional migration practices. There is some variation from year to year, due to local rainfall conditions. When drawing boundaries for proposed ranching associations these migration patterns should be kept in mind. The Masai will not favor forming an association that does not include the dry season grazing areas.

Range Condition

Evidence of overgrazing exists throughout the Loliondo District. Large areas have been almost taken over by climax shrubs and unpalatable grasses. Brush, a major problem in some areas, often is so dense that mechanical equipment or herbicides would be needed to remove it.

Livestock

Over 200,000 head of cattle exist in the area; obviously this number would have to be sharply reduced before range conditions could be expected to improve. The poor performance of young stock observed reflects the poor range conditions. Stock quotas should be a major requirement of this ranching association but obtaining Masai cooperation in setting realistic quotas presents a major challenge.

Large numbers of game contribute to the overgrazing condition. This area seems well suited for game cropping practices and pilot-type harvesting programs are underway by the Game Division.

Marketing

Most cattle marketed in this District pass through illegal markets. Also, the prices paid for cattle are quite low and compare unfavorably with other areas. (See the Marketing section for details.) This low price, plus an inefficient marketing system, encourages Masai to hold cattle on the range which contributes to the overgrazed conditions. Before cattle numbers can be reduced vast improvements in the marketing structure will be needed. Area Masai are well aware of the poor market conditions and are very interested in cooperating to improve them. A number have agreed to try marketing some cattle by weight. Perhaps no action could improve range conditions more than reducing livestock numbers by marketing more of them.

Disease Problems

East Coast Fever is limited to one locality. The Masai, encouraged by the Regional Veterinary Officer, have consented to limit movement of infected herds in the area to prevent the spread of the disease. Trypanosomiasis exists but does not seem to be a major problem since tsetse-free areas are available for shifting infected stock into to facilitate their recuperation. The Masai are quite verbal about the difficulties encountered in obtaining chemotherapeutics (mainly novidium). A stockpiling of these drugs by a Masai association under the supervision of the Assistant Field Officer or the Veterinary Officer could alleviate the problem. Streptothrylosis occurs but is not a critical problem.

Tribal Patterns

Several Masai tribes are represented in the Loliondo District (Figure E). Some have a history of conflict with certain other tribes. In forming associations it will be important not to encourage associations that cut across tribal lines unless those tribes have a minimum of conflict. However for efficiency, some of the smaller tribes may want to combine with another tribe.

Recommendations

The formation of a number of associations should be started immediately with the elders councils in the area.

The main reason for forming the association should be to improve the market. Later, disease control and other problems can be introduced for association action. Stockpiling needed veterinary drugs would be a project with wide appeal.

The Masai should accept the principle of stock quotas before an association can be formed. However, quotas should not be enforced before an adequate marketing system is in full operation. There should be full agreement with the Masai as to the exact time the stock quotas will go into effect.

In drawing association boundaries, special attention should be given to normal wet-dry season grazing, migration patterns, and to tribal boundaries in the area (Figure E). Having dry season grazing areas outside the association boundaries should be avoided. Masai tribes that have a history of conflict should not be permitted to belong to the same association. Some of the smaller neighboring tribes which get along well with each other should be permitted to form an association together if they wish.

The area in the northern part of the district that has all-season water and grass appears to be a good place to start the first association.

Initially, associations should be kept small. Later they can expand if desirable. Marketing activities will require large membership so it is possible that small associations will have to join in marketing efforts. Local elders council or tribal boundaries might serve as association boundaries. In any case, the wishes of the Masai involved should be followed.

OLMOTI

This area has been under consideration since 1962 for development into a ranching association and was actually granted the "rights of occupancy" in 1962 by the Commissioner for Lands. Under the Range Act, the interested parties must reapply for status and certification as a ranching association.

This 18,000-acre area is uninhabited now due to lack of year-round water. Approximately 12 individuals would make up the initial membership with an initial stocking rate of approximately 1,000 cattle. A thicket along the Olmoti River (Figure D) reportedly contains Glossina, and therefore must be considered a potential tsetse infected area until thorough survey work has been conducted.

Water Sources

Water is now provided by a 300 foot borehole. It has a tested yield of 1,100 gallons per hour, but is needed to operate it. Since it is located in an mbuga (swamp) area, piping water to a higher location approximately one-half mile away may be necessary in order to avoid watering cattle in a low swamp area.

Geological conditions seem favorable for finding water by drilling southeast on the Nguatella Hill. Also, suitable sites for surface water dams may be found in the area's easterly portion.

Tsetse along the river is a major problem, since cattle grazing along the southern sections have to move through this area to get to the water point. This movement could spread tsetse contamination since these flies tend to follow cattle. But there is probably no economic justification for developing two borehole sites to serve 18,000 acres, particularly if sections of this are infested with Glossina.

For these reasons expanding this association area to include some 45,000 acres to the south of the highway (lying between $36^{\circ}40'$ - $36^{\circ}45'$ east and $4^{\circ}5'$ - $4^{\circ}15'$ south) with a corridor to the west along $4^{\circ}5'$ to give access to the water supply at Sukura dam may be wise. This reservoir has

a clean deep capacity of 139.5 M.G. with water depth of 20 feet (per Kametz report). This area should accommodate an additional 30 families and 4,000 head of livestock.

Recommendations

Steps should be taken as soon as possible to register this association, utilizing the Catholic Mission personnel and Edward Mbarnote, a well informed and ambitious Masai, to provide the management and guidance required. This would minimize the amount of time required by Range Commission personnel for detailed study.

Expansion south should be seriously considered.

A school planned for in the Nguatella Hill area should form the hub of activities for the association. This school may include training programs in animal husbandry for area Masai. If the association expands south, using this school as the administrative center may no longer be convenient but this possibility should not discourage going ahead with present plans.

Additional water points should be provided in the proposed 18,000-acre portion, to make water available at the southern and eastern end of the tract to minimize travel across the drainage way or river basin with its possible tsetse infection.

A detailed Glossina survey should be conducted, if not already done (the exact status of this was not obtainable at the time of the study).

Brush should be removed from the areas indicated. This would increase the carrying capacity of the 18,000-acre area.

PERSONNEL

EXTERNAL TECHNICAL PERSONNEL

Because of the scope and complexity of the problems of range development in Masailand and the small numbers of qualified trained personnel available, there is a need for external technical assistance.

The following numbers and types of personnel are recommended:

Marketing Specialist

Qualifications Should have experience in marketing livestock with first hand knowledge of cattle evaluation by types, grades, and yields. Should be familiar with marketing programs in other developing areas, particularly with nomadic type production. Should be familiar with the problems encountered by and advantages of livestock marketing organizations.

Duties His primary concern should be to develop livestock marketing in Masai District which should also involve him in national livestock marketing programs and studies. His scope of activity may extend to Kenya and Uganda and regional marketing programs. This technician will also be responsible for designing and conducting detailed surveys within association areas to get basic information on cattle production and other information essential to develop associations on a sound economic basis.

Agricultural Engineer (Hydrologist)

Qualifications Should have broad experience in an organization like the USDA Soil Conservation Service and in designing and constructing water-flow retarding structures, particularly the Drop Inlet type. His experience should include installing gully control and grade stabilization structures, farm ponds, open channels, spring and well development, and water supply pipelines. He should understand the principles of Soil Mechanics in constructing earthfill dams and hydraulics in designing channels and in flood routing through reservoirs.

Duties An Engineer is needed for a two year initial assignment, primarily to Komolonik, to complete water supplies recommended in the report. He should help determine the water requirements in proposed ranching associations in Masailand and working closely with the marketing programs, review existing water points along the principal Masailand stock routes and recommend improvements.

Animal Production and Animal Health Specialist

Qualifications Must have general practical knowledge of the science of animal production (nutrition, management, and breeding) and be aware of etiology and control of livestock disease problems of East Africa.

This technician must have experience working with nomadic livestock peoples, know their practices, and be capable of establishing a working relationship with the Masai. Considering the major efforts underway by the Veterinary Division to control livestock diseases, it is advisable that this position be filled initially by a veterinarian for maximum rapport with the Veterinary Division. This is not to infer that the areas of livestock nutrition and management are of lesser significance.

This specialist must be capable of advising on applied research and demonstration projects with livestock. A knowledge of methodology in mineral nutrition and research will be helpful. He must also be familiar with all past and current research work on animal production and disease control applicable to East Africa.

Duties He will be responsible for providing direction to animal production and disease control programs in association areas and for working effectively with Range Commission and other Ministry personnel in developing livestock improvement programs for Masai district in general.

He should backstop the extension programs and help develop the needed basic survey information.

Extension-Sociologist

Recognizing the importance of cultural factors in this project, we strongly recommend that the team include a person trained in extension methods and rural sociology.

Qualifications This person should have training in Rural Sociology and Extension Education. He should have experience in extension field programs and extensive experience in social change programs.

Duties

1. Provide training for Ministry of Agriculture field staff in extension methods and philosophy and in effective techniques of introducing social change.
2. Serve as advisor to other members of the team on extension methods and social change techniques that are particularly compatible with Masai culture.
3. Become well informed on Masai culture and maintain effective communication links with the Masai.
4. Conduct studies when necessary to provide information needed for program development and evaluation.
5. Help to develop continuous evaluation procedures and maintain a running evaluation on the effectiveness of the various programs instigated.
6. Develop and initiate extension education programs for Masai men, women, and youth, including discussion groups and demonstrations.

Location

The team should be based at Monduli/Arusha to work in all of Masai District. Although based here the team should not concern itself solely with Komalonik. Team efforts should also be directed to Kijungu, Olmoti, and Loliondo, and travel and housing plans should provide for regular and frequent visits to these areas.

IN-COUNTRY PERSONNEL

This section describes positions, qualifications and duties for personnel expected to be available from within Tanzania. This does not imply that such personnel are not presently available nor that those holding positions are not capable. However, further training in some instances may be needed.

Association Managers

Qualifications An association needs a full time manager who should be a Masai. He should be able to communicate with the technical Range Commission personnel. He should be able to perform or be trained in simple accounting-bookkeeping. He must be well informed on range and livestock production.

Duties and Nature of Position He would be paid by funds set in escrow from the Association. He would be responsible for expediting the programs agreed upon by the elders councils and for representing the views of the elders councils to the Range Commission officers when necessary.

The Association Manager should not be directed by the Range Commission officers; rather the Range Commission should support the needs of the Manager. When official actions are involved, the Association should be represented also by representatives of the elders council of the Association.

NOTE: Additional short-term advisory personnel may be required, such as a soil survey specialist for the land use reconnaissance survey.

Appendices

KOMOLONIK RANCHING ASSOCIATION

Ref:

SURVEY OF

(Date)

Enumerator:

Supervisor:

Code number of family

(Head of family)

Section Location

(Name & position of person giving information if not
head of family and reason
for absence of head of family)1. Family Data Wives Children Relatives
..... Others

Dependent on family herd	Age			Total	Children living most of year away from home	
	5 yrs	5-15 yrs	15 yrs		School+	Elsewhere
Female						
Children						
Male						
Relatives						
Others						
Employees						
Total dependents						
Plus	Head of family					
	Wives					

Names & group affiliation of males

+ Specify number of boys at secondary school or above

2. Livestock Numbers:

Class of livestock	S.U. Factor	Family herd						Stock of boma owned by of		
		At boma			Elsewhere			S.U.	♂	♂
0-1 yr		♀	♂	♂	♀	♂	♂	♀	♂	♂
Immature										
Mature										
Sheep										
Goats										
Donkeys										
Total stock units		Family herd kept at boma			Family herd kept elsewhere			Other stock kept at boma		

(♀ = Females, ♂ = Males, and ♂ = Castrates.)

3. Changes in stock numbers during past year:

Intake /Offtake	Cattle					Sheep	Goats	Reliability of Data		
	Calves	Steers/Bulls 1 to 3 yrs.	Females Heifers	Cows				High	Mod.	Poor
Born										
Acquired										
Purchased										
Total intake										
Predators										
Lost										
Disease										
Stolen										
Slaughtered										
Market										
Sold										
Elsewhere										
Total offtake										

+ Specify origin of purchase, with price if available
.....

4. Income during past year (in cash or kind)

Sales	Price/ Unit	Income
Livestock		
Milk		
Hides/Skins		

Other Sources	Person Involved	Income
Stock trading +		
Herding for		
Off-ranch employ- ment (specify)		

Shamba ft ft, or acres, producing
the following crops (yields if available)

.....

+ In respect of livestock not already included under item 3.

THE NATURE OF MASAI CULTURE

Many writers have expanded upon the cultural factors relating to the adoption of new technology and the introduction of cultural changes. The very nature of the culture influences what innovations will be adopted, the speed of their adoption, and the process by which adoption takes place. Anyone wishing to introduce technical and social improvements into a society should become thoroughly familiar with the cultural factors involved. By thoroughly understanding the cultural factors, the change agent can style his approach so as to get the greatest amount of adoption in the shortest length of time. There are a number of factors to be considered when studying a new culture. Such things as social and political structure of the society, the basic value orientations, the customs and the means of cultural control are all worthy of serious consideration. These items will be considered more fully in the following paragraphs:

Social StructureA. Tribes

The Masai-speaking people are divided into tribal units. In Tanzania by far the largest Masai tribe is the Kisongo, with approximately 73 percent of the total Masai population. The next largest group is the Loita, with approximately 7 percent of the Masai in their midst, with the Serenget, Laitaiyok and the Purko each making up an additional 4 percent. The Salei have five percent of the total and the Sigrari have three percent of the Masai population in Tanzania. These figures are approximate in that the movement of families makes an exact count impossible. The Kisongo tribe also occupies a large geographic area covering mainly the Masai steppes. A person's whole status and traditional legal rights are designated to these tribal groupings; the tribe being the best organized structure for corporate action except for the age groups which will be discussed later. There has been much conflict between tribes over the years and much raiding of cattle occurs between the tribes as well as some within a tribe. Tribe loyalties were particularly strong during periods of conflict and open warfare. As a result of this history of conflict, it seems doubtful that cooperative ventures between tribes could be as effective as those within a tribe, except during periods of severe crises involving the future of the Masai-speaking people as a whole.

It should also be noted that traditionally the tribe was the largest territorial grouping in which disputes were settled peacefully and decisions made. When the size of the tribe is small and when the area occupied by the tribe is small a great deal of cohesion develops. When there are many members of a tribe in a vast area, however, the cohesion is limited to times of severe crises when all localities are threatened.

It should also be noted that the Maa-speaking tribe locally called Warusha (Arusha) that have a different cultural and historical origin and traditionally were not called by themselves and others "Ilmasai." Warusha appear to be more oriented towards the technical and economic sectors of modern society. Thus, many of the Masai that are pointed to as having modern education and making use of technology are in fact members of the Warusha tribe. The main significance of this is that the rest of the Masai have a great deal of contempt for the Warusha and tend to downgrade them and their behavior. Therefore, much of the so-called progress that has been attributed to the Masai is lodged in a tribe that is despised by the majority of the purely pastoral Masai with the result that the alleged progress has had little impact on the majority of the Masai people.

There is extensive intermarriage between Masai tribes, particularly the smaller tribes. The wife in these cases imparts loyalty to the tribe of her husband. Cultural changes appear to take place as a result of intermarriage. Particularly in those customs and duties normally ascribed to the woman. The most noticeable illustration of this is in the house design of the pastoral Masai that have married Warusha wives. The house in this case follows the design of the Warusha and is readily noticeable from the traditional pastoral Masai house.

B. Clans

Clans designate the parental heritage of the husband by tracing back through the family line. It should be noted that clans cut across all tribes because of the intermarriage between the various tribes and thus sufficient numbers of potential marriage partners are more available.

During times of severe drought or other tribal crises, members of one clan will seek out members of the same clan residing in

another more fortunate tribe in order to solicit assistance. The request for assistance must be honoured. Thus there is clan loyalty and obligation to assist fellow clan members though this varies from one locality to another. In some localities water rights are designated on a family or clan basis. In general, clan relationship is on a mutual help basis between blood relatives with norms being enforced as a result of this relationship. Wives are acquired in a logo-ritual ceremony, involving the handing over of cattle bridewealth. These cattle must include at least one milk cow and heifer. There has been some increase of marriage with other than Masai tribes because often these wives can be acquired with steers. The bridewealth is standardized at four head of cattle and two sheep (the latter going to the bride's mother), but the whole process of acquiring a wife may require the giving of additional animals as "gifts." Most males are approximately 30 or older when they marry, since they are not permitted to marry until they become senior warriors.

The role of the wife includes cooking, sewing, preparing of skins, carrying of water, building of houses and, when moving, transporting all household goods. The wife also does the marketing for foodstuffs. Men tend to make all the political and social decisions affecting the family, boma or tribe. Men also handle the cattle buying and sale and the treatment of diseased or injured cattle.

The herding of the cattle is usually done by small boys under the supervision of elders. Occasionally, if there is a shortage of boys for herding, a young girl may be pressed into herding duties. Each wife is assigned a number of cattle to milk for the family food supply and to care for their calves. Although the cattle are nominally hers, she does not own them since the husband retains ultimate ownership and can sell or give away any of them--although generally he would not do so without consulting his wife. In case of the death of her husband, she cares for the cattle until her eldest son becomes of age.

C. Age Sets

The Masai divide all males into grades according to their age and the time of circumcision. One grade is the ol-ayioni (plural il-ayiok) which is the boys before circumcision. Another grade is the ol-murrani (plural il murran) which is the warrior group. A third grade is the ol-muruo (plural il moruak) which is the group made up of elders.

Members are recruited from the boyhood grade for circumcision during a declared period of open circumcision. The open period is set by the ritual expert in the area. After circumcision, the boys move as a group to the warrior grade. During the period of circumcision, the name of the age-set is given and the boys develop the closeness that group activities foster.

Normally there are two age-sets in the warrior grade and two age-sets in the "active" elders grade. When a new age-set is formed and moved into the junior warrior grade, the other age-sets move up one place. Thus, junior warriors become senior warriors, senior warriors become junior elders, junior elders become senior elders and senior elders retire from active political life. Retired elders are permitted to attend Council meetings but are expected to play a minor role in the proceedings. This has some significance for Government programs in that often the Government continues to work with elders who have moved into retired status and thus lack influence. In some tribes where the government has put pressure on the il-murran for National Service, they have been moved into the elder group prematurely. In general, age-sets of all Masai tribes move all to the next group within four years of each other throughout Masailand.

During the period of boyhood the boys spend most of their time herding cattle and learning about cattle care and grass management. At this point they have little status in Masai society and are expected to do all the jobs and not attend or, least of all, take part in any of the meetings where issues are decided. Generally, their existence is a lonely one since they spend most of their time herding cattle.

Upon becoming an ol-murrani, a boy's whole life changes. It is at this point that the boy gets full training in the customs and expectations of the Masai. He is expected to be the strongest, bravest and the most skilled fighter of the society. This image has been so well ingrained into the Masai culture and surrounding tribes that most non-Masai groups put great stock in the ferociousness of the Masai and are usually quite afraid of the il-murran with spears. Actually, bloodshed is avoided by the majority of the Masai and the incidents of violence are actually very few when one considers the number of il-murran and the emphasis put on fighting ability.

Previously, the il-murran lived in separate villages called e-manyata. Since these were the places where cattle raids were often planned, the Tanzanian Government outlawed these villages and have been effectively preventing their formation. The il-murran are removed from all duties of cattle raising except in emergencies. Their main responsibility is to protect the herd in the community

from harm and to carry out whatever social and public services are needed. The *il-murran* travel from boma to boma and serve as effective carriers of news and information. To announce a meeting one needs only to inform one elder and he sends the *il-murran* from his boma to the surrounding bomas and the *il-murran* from each of these fan out to notify others. Thus, in less than a day word has reached all persons in the locality.

In general, the *ol-murrani*'s life is a carefree simple one with few responsibilities and a great deal of social life. When *il-murran* visit a boma, they must be offered food and drink, even if it means that the family goes without. One gets the feeling at times that since cattle stealing is dealt with harshly by the law, and since tribal wars have become nearly non-existent, with the exception of an occasional lion hunt, the *il-murran* in Masai society is becoming less vital as Government and law take over more and more societal responsibilities.

While the *il-murran* have suffered a decrease in responsibility, the elders have maintained their importance and may have actually increased their relative position in Masai society. Their main responsibility is making the basic political and social decisions of the society. In issues of major importance the *il-murran* may be consulted, but women and boys never are. Decisions are made by free discussion of all elders present.

The meetings of the elders run to three basic types of decisions. One type deals with decisions relating to cattle care. These are usually made daily and involve such things as where the herd should be grazed, which boys should do the herding, where and when the herd should be watered and if a boma move is warranted to areas of better grass or more water. These decisions usually are made within a single boma and other bomas are seldom consulted.

The second type of decision-making is made to serve as a kind of local court where disputes between members of the tribe are settled. The elders' decisions are final and carry all the weight of the society. The elders also have the responsibility of levying fines and punishment on those having done injustices to other individuals or to the group.

The third type of decision-making might be called "affairs of state." This involves entering into agreement with Government officials or other tribes or groups in the area. The elders as a group are the only ones able to enter into such agreements on behalf of the members of the Masai society. Individuals, of course, may enter

into agreements of their own, but these are not binding on the other members of Masai society.

Another important feature of Masai age-sets is the bond that is established between alternate age-sets. This bond arises from the fact that the alternate age-set above is responsible for creating and supervising the activities of the age-set below. Therefore, junior elders are linked to junior warriors, and senior elders to senior warriors. In this way, each warrior age-set has a corresponding age-set in the elders grade to look after their interests. Likewise, the age-sets in the elders grade have a special bond with the alternate warrior age-sets who as a strong physical force can enforce the decisions of the elders council.

Political Structure

If one is to institute change programs and development activities that require the cooperation of the Masai, it is vital that the political structure and the process by which decisions are made are known. By weaving programs and innovations into the existing political structure a valid decision can be made and more rapid development of action programs can be undertaken.

A. Locality Covered

The locality covered in a decision-making process will vary according to the type of decision and the number of the Masai being involved. Decisions affecting an individual herd, family or village will usually be made at the boma level. In some instances, where grazing patterns or procedure for watering cattle at a specific waterhold, a number of bomas will be affected and therefore the elders from both bomas will get together to work out the details. Most decisions involving the settlement of disputes, the punishment of wayward members, or entering into agreements are held on a locality basis.

Localities are set by traditional patterns long established as being a single unit. It is in these localities that the elder councils (engigwana) regularly meet to settle disputes and make decisions for the locality as a whole.

The localities usually cover a number of square miles and involve a great number of bomas. The actual size of the locality

varies from area to area according to geographic boundaries and normal wet and dry season grazing patterns. In some instances, however, the discussions will be held on a tribal basis when affairs are to be discussed that will affect the whole tribe. This is particularly true when one tribe occupies a relatively small area. In instances such as the Kisongo, which occupy a large geographic area of Tanzania, tribal meetings are rare. There have been instances of representatives from all tribes getting together to discuss vital issues. These have usually resulted from pressures of the central Government and they are not normally carried on as natural events. The most vital unit for decision making, therefore, would be the locality where regular elders council meetings are held.

B. Leadership

The Masai society provides for leaders of the various activities involving their life. The most prominent of these is the person who serves as leader for the elders in the local elders council where most of the important decisions are made. This leader is called an ol-aiguenani (plural il-aiguenak) and is roughly comparable to a chairman in western society.

Each age-set also has an ol-aiguenani to serve as a spokesman for the members of that age-set. The ol-aiguenani has no real power except his personal power of persuasion and by virtue of his office as chairman. He cannot make decisions for the group, nor can he represent the group's opinion except when so instructed. The Masai require that their ol-aiguenani be a clear thinker, calm, fair, and honest in chairing the meetings and be an eloquent speaker and thus be able to arouse others to his point of view. It should be noted that only the ol-aiguenani can officially call a meeting where decisions are made that are binding. Masai elders will be most willing to get together at any time to discuss an issue, but no decision can officially be made unless a meeting is chaired by the ol-aiguenani. Other leaders may be appointed to carry out certain responsibilities but they have no power to make decisions or lead the group in the decision-making process.

The ritual expert is another leader and is called ol-oiboni (plural il-oibonok). This leader has a number of functions. First, he has the responsibility of effecting cures on ill persons and cattle. Secondly, he also has the power to place and remove curses.

The third and perhaps the biggest responsibility is to serve as ritual expert to the Masai. Many activities of the Masai could not

go on without the approval of the ol-oiboni. The ol-oiboni must declare an open season before recruitment for circumcision rites can be undertaken. Also no cattle raids by the il-murran can occur unless the approval of the ol-oiboni is received. As far as political decisions are concerned, the ol-oiboni has no power and is seldom consulted. In the past, an effort was made by some Government officials to involve the ol-oiboni in agreements with the Masai. Since the ol-oiboni has no power of decision-making for the group or any power of enforcing these decisions, the agreements entered into by the ol-oiboni are considered nonbinding by the rest of the Masai society. Obviously, though, the ol-oiboni does have a great deal of personal influence over other members of the society. However, it should be noted that the position of ol-oiboni is passed on from father to sons within the same family (clan) and the personal influence of any one ol-oiboni is due mainly to the prestige that he has been able to develop as a result of his actions.

The Masai, therefore, can be said to have no chief and no hierarchy of decision-making except those that might be awarded the elders. Therefore, the decisions entered into by the elders resemble a pure democracy in form. The il-murran may be consulted during the discussions of vital issues, but usually the discussions by il-murran are limited and lacking in influence.

C. Decision-making Process

When an ol-aiguenani holds a meeting, he waits until all are present and then presents the issue to be discussed. Usually at this point one of the respected elders will get up and make a short, or sometimes not so short, speech spelling out the importance of the issue and the necessity for a decision on the matter. He may also state a position as to what he feels the decision ought to be. Others will then express their views as to the desirability or undesirability of the proposed issue. The discussion will circulate without any set order around the group, a special effort being made to express all the positive reasons for taking a specific position and all the negative reasons why such a position should not be taken.

It appears that some serve as devil's advocates by expressing as many of the negative positions they can think of. If all negative positions are answered satisfactorily, it is then felt that a positive decision can be made and one is usually reached in an amazingly short period of time. It is somewhat amazing to outsiders that after hours of discussion as to why a certain position should not be taken, they will quickly decide to accept it. This is the result of the Masai making sure that all possible objections have been raised and dealt

with. Visitors and outsiders at the meeting are welcome to present their views and argue the case. If an agreement cannot be reached, the meeting is broken up, to resume another day. On really key and controversial issues, the discussions and deliberations may go on for a number of days.

While to outsiders and change agents anxious to have decisions made to get programs activated, this may seem like a long and tedious process. It should be remembered that when a decision is made in this manner, it is a firm one that is very unlikely to be changed later and that since all members have been involved in the decision, full support can be expected from all segments of Masai society. It should be noted that by this process seldom are hasty decisions made, since a great deal of time and thought goes into the decision-making process.

In the other type of decisions involving a punishment of wayward members of Masai society, all members are permitted to give their views on the case. The person bringing the charge has the opportunity to present full details of the charge while the person being charged also has equal opportunity to state his side of the case. Both sides of the case are discussed by the elders and a decision is assumed to be binding on the individual. However, there are cases where individuals have delayed paying their fines for considerable lengths of time. Certain fines are set by tradition and require limited amount of discussion.

It can be seen from this discussion that the decision-making process of the Masai society is a long involved affair, but one that involves all male members of society and avoids rash, hurried decisions.

Value Orientation

The Masai, like any other society, have their own system of what they feel is important and what is considered good or bad. The Masai culture is oriented around cattle, since their very existence depends on their herds. Cattle provide the means for food, clothing and shelter, as well as cash for other necessities and pleasures. In spite of this complete dependence on cattle, the Masai have not developed any worship of cattle. Cattle, to be sure, are involved in ceremonies and rituals, but are not the object of these activities. In general, the Masai take a very pragmatic view of cattle and life in general. A more detailed discussion of the value orientations of the Masai follows.

A. Wealth

One way of determining the values of a social system is to find out what things the wealthy or fortunate person is viewed as having. To the Masai, a truly wealthy man is one who has many children, particularly boys. Children above all else are admired by the Masai. Much has been said of wives and number of cattle, but it should be remembered that the more cattle a man has, the more wives he can afford and therefore the more children he can have. The cattle, of course, are valued because they serve as means of security for the Masai. The more cattle one owns, the better able he is to handle the emergencies. If some cattle are lost because of disease or drought, there will remain enough to feed the family. Also, if an animal dies, it can be eaten so that it is not a loss. A man is careful not to acquire too many wives lest he spend all his cattle for bridewealth and will not have enough remaining to support him. In general, a man who has a large herd of cattle has a sense of wellbeing because he feels secure, while a man who has many children receives praise from his neighbours.

The Masai do place a great deal of value on quality of cattle in spite of the claims to the contrary. They are well aware of improved stock and are quite interested in cattle that will do better under their conditions.

Cash is a form of wealth that the Masai is quite well aware of. However, the Masai do not attempt to accumulate large amounts of cash. They would rather have their wealth in cattle so that they can receive the milk from them. Also, the Masai know and understand cattle and feel able to make a profit from investments in livestock. They normally do not trust savings accounts or other forms of returns on money.

It should also be remembered that the Masai get a great deal of personal pleasure out of watching and handling cattle. This affection for cattle rarely exceeds the limits of practicality, however. The Masai are extremely practical people and will try new things if they are shown that it is practical under their conditions. The Masai will carefully analyze a new idea and will determine as best they can what will be the short and long range benefits and disadvantages. It may be said that the Masai are security oriented in that most of them are not willing to take high risks. This view seems logical in light of the natural risks they must endure of climate and disease. The Masai want to place only a limited amount of risk on top of the already great risk of natural catastrophe. It should be pointed out that there is developing a new kind of Masai businessman or cattle dealer. For the most part, these are il-murran that begin buying and selling cattle. Many of them are quite skilled and accumulate a sizeable amount of cash. However, it would seem that most of these new cattle

dealers have as the ultimate objective the buying of a herd of their own. Therefore, they view the business enterprise as only a means of acquiring a herd so that they can get a good start in ranching. However, it seems likely that there will continue to be more and more Masai in the business side of the cattle industry and some of them will likely take this as a permanent occupation.

B. Behaviour

The Masai place a great deal of emphasis on a number of ideal behaviour patterns. First is the idea of what is appropriate work for the men. The Masai view God as being in the sky, and therefore things that are near the sky are considered good and things away from the sky are less desirable. Also, the Masai believe that God gave them the cattle and therefore all cattle actually are rightfully theirs. They, thus, view cattle raising as the only honourable occupation for a Masai, since to do otherwise would be violating the wishes of God. To engage in such activities as digging in the ground is particularly condemned since this is not raising cattle and is working away from God since He is in the sky. The Masai will do a limited amount of digging if it is related to cattle raising and is absolutely necessary. One instance might be the clearing of wells so as to have water during the dry season. However, even in these cases the Masai prefer to hire others to do the work rather than engage in it themselves. In some cases the Masai have taken to growing maize as a result of the drought of 1960-61, but this practice is still very rare. Many times cultivation is observed, but these cases usually turn out to be Warusha families who do not have strong beliefs against such activities. In general, it may be said that the Masai will engage in labouring activities if it is necessary for the survival of their cattle or families, but only under such emergencies.

Following their belief that cattle were given to them by God, the Masai feel that all cattle are rightfully theirs and, therefore, it is not wrong to steal cattle from others. In fact, it is felt by some to be their duty. The Government of Tanzania has taken a strong stand against cattle theft and has been fairly successful in apprehending violators. The Masai, being a practical people, have generally yielded to Government pressures, but there still exists the desire to renew cattle raids. Raids against other Masai are frowned upon, particularly raids against ones own tribe! The ol-oiboni keeps a check on inter-tribal raids by refusing to endorse such activities.

The Masai place a strong value on honesty and fairness in their relationships with each other. They do not feel any such restriction on their relations with outsiders. However, many Masai develop a

habit of honesty and have not been told that they do not have to deal fairly with outsiders. Thus, many are completely trustworthy in their relationships. Since the Masai value honesty they appreciate it in others and will deal fairly with those who they feel deal fairly with them. The Masai who does not deal fairly with his fellow tribesmen soon loses prestige in the Masai community and may find himself isolated.

The Masai place a particularly strong value on sharing. Whenever a man gains wealth or good fortune, he is expected to share it with his neighbors. If a steer is slaughtered, the meat is expected to be shared by all. Certain parts of the animal is given to individuals according to their position in Masai society. There are many stories that the Masai tell to their children about greedy individuals or animals and the misfortune that befell them as a result of their greed. Not only are individuals of good fortune expected to share their wealth, but victims of misfortune expect and receive help from their neighbors. If a man's cattle die as a result of disease, he will be provided with a new start by one man giving him a cow, another a couple of heifers, another a bull, and so on.. Also, a more wealthy man may loan him a couple of cows to be milked for his family until he is able to build up his own herd. However, if a man loses his herd as a result of foolishness he may not be given any help by his neighbors. There seems to be an increasing number of problem drinkers among the Masai and this has caused some loss of herds through neglect. The Masai do not feel any obligation to help in these cases.

The Masai believe that each man is equal in Masai society. This means that each man has an equal opportunity to participate in the affairs of the society. This is particularly true in the case of decisions affecting the group. When a decision is reached that money is needed for a community project, all men pay an equal amount regardless of their wealth. The Masai feel that this is the only fair way.

The Masai do not normally count their cattle and in fact feel that it is bad luck to do so. Animals and persons counted may bring misfortune or death. Masai owners of cattle know each animal individually and can quickly spot if an animal is missing. The counting of cattle is also looked upon as one form of boasting. The Masai feel very strong strongly that it is wrong for a man to brag about the quality or quantity of his cattle. In fact, it is very bad taste to compliment a man on his cattle. However, one is expected to tell about trips and experiences with full details of brave or clever deeds.

The Masai feel that wildlife is part of God's plan and should not be disturbed. God gave the Masai cattle to provide his food and therefore He does not expect the Masai to eat game. The Masai therefore live in

harmony with the wildlife and kill only predators which are a direct threat to their stock.

C. Customs

A number of Masai customs will be discussed that are particularly relevant to ranching schemes. First is the dietary custom of the Masai. Milk is the main food both in fresh and curdled form. During the wet season when there is plenty of milk, the Masai exist nearly totally on it. Sheep, goats and beef make up part of the diet throughout the year. Since the drought of 1960-61, the Masai have been utilizing maize during the dry season when milk supplies are low. The cows are usually milked morning and night, and with some milk being left each time for the calf. It is therefore evident that a sizeable herd is needed to provide for both calf and human milk needs during the dry season when production is low.

The Masai normally develop a definite grazing pattern for each locality. The pasture immediately around the boma is reserved for small calves and pastures a little further out for the yearlings. The boundaries are strictly adhered to by the herd boys. A whipping being the punishment for letting the mature herd wander into the calf pasture. Pasture is usually reserved for dry season grazing. The grass around permanent water is reserved for dry season grazing when other watering spots have dried up and the cattle must be moved to year-round water. Upon the beginning of the rainy season and the return of water, the cattle are moved away from the permanent water holes to permit the grass to recover. Also, regular migrations are made from wet season pasture (where salt may be more plentiful) to dry season pasture, where rains are more prevalent due usually to hilly topography. Disease problems are usually more severe in the dry season pasture, and the herds usually return to wet season pasture at the start of the rains.

All major celebrations involve a meat feast. The Masai regard it as sinful to have a feast just for the sake of eating meat. A marriage, birth or initiation of a new age-set are all occasions for such celebrations and the resulting meat feast. Steers are the main source of meat for celebration, since cows are more valued for milk and certain rituals. Many Masai keep extra mature steers in the herd to have them handy for such occasions. Gifts, bridewealth, fines, blood-price and other social responsibilities must always include a good proportion of cows and heifers. The actual number often being prescribed by tradition. It can be said that not only does cattle play an important role in providing food, clothing and shelter, but also has a major role in the ritual life of the Masai.

D. Sanctions

The Masai use the elders council to punish those members of society that violate the norms--the wayward member may be fined in cattle, usually in a number prescribed by tradition. For instance, a person committing homicide must pay a blood-price of 49 head of cattle. Elders determine the size of the fine in cases where tradition has not set the fine. The elders also have the power to place curses to assure compliance with rulings. For instance, the elders may place a blanket curse that would fall on anyone who uses the dry season pasture around a permanent water hole before the allotted time. Individuals who have been wronged may ask the elders council for permission to have a curse placed on the offender.

In cases of repeated violation, the council or the elders of a boma may ask the person to leave. In serious cases, the expelled member may not be permitted to join any other boma. Persons who are out of favour with the society may have difficulty in marrying or, if married, the father of the wife may come and take back his daughter and return the bridewealth. In general, it can be said that the Masai have an effective method of enforcing the norms and rules of their society.

Bibliography

For a further more detailed account of the Masai, the reader is referred to the following authoritative works:

Yacobs, Alan H., The Pastoral Masai of Kenya: A Report of Anthropological Field Research, Ministry of Overseas Development, Eland House, Stag Place, Victoria, London, 1963

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MASAILAND WILDLIFE MANAGEMENT PLANIntroduction

In order to preserve and utilize the great wildlife heritage of Masailand which is threatened by insufficiently planned land use a wildlife plan is essential. The purpose of these recommendations is to put forward ways of conserving wild animals and utilizing them to the greater benefit of Masailand and Tanzania. The urgency of these recommendations is to be found in the sudden opening up or extension of agricultural activities into ecological conditions which are incapable of safely supporting them.

Recommendations

The object of the plan is by comprehensive overall land use planning to utilize in the wisest way the natural resources available, and in particular to ensure wildlife utilization is integrated to the greatest benefit and least conflict.

Geographical AreasAreas South and East of the Moshi-Arusha-Dodoma RoadI. Burunge Game Controlled Area

- a) Relative Importance: The eastern half of the area provides wet season habitat for very few wildebeest, onyx, buffalo, hartebeest, giraffe, rhino, elephant while resident species are similar to the Tarangire. Besides holding the Tarangire overflow in the dry season it provides a migration route between Tarangire and Lake Manyara area (see map). However, this has been rendered useless because of extensive settlement. Also eight roan (nearly extinct in Masailand) still exist southeast of Galapo. A part ecologically of the Tarangire ecosystem and essential to the Tarangire.
- b) Recommended Utilization: Low density settlement in the western half of this area to be protected from predators and elephant by a settlement restricted zone to cover the eastern half of the area. Most of this zone be placed within the National Park to ensure safety of the ecosystem and a game fence to be constructed if experience shows that other methods such as alternative water are not effective to restrict the animals within the set limits.

II. Tarangire Game Reserve.

a) Relative Importance: This area is of paramount importance as the essential dry season habitat of a large percent of central Masailand's wild animals.

Resident Species: Impala, waterbuck, reedbuck, rhino, lesser kudu, steinbuck, duiker, leopard, elephant, etc.

Dry season Migrants: Large concentrations of zebra, wildebeest, buffalo, elephant are found at Matete and Tarangire where water is found. Other migrants include eland, giraffe, lions.

b) Recommended Utilization: To be made a national park for:

- 1) Conservation of fauna and flora of the area;

- 2) Developing potential for a) tourism, b) education and c) research.

III. Lolkisale Game Controlled Area

a) Relative Importance:

- 1) Wet season habitat migrant zebra, eland and wildebeest herds occupy the grassland and flood plains while elephant and buffalo herds occupy open to dense woodland (see migration map).
- 2) Permanent habitat impala, oryx, eland, rhino, kudu, giraffe, gerenuk and lesser antelopes are resident of this area.

Lolkisale holds the Tarangire game overflow during the dry season. All of the controlled area is an important buffer zone.

b) Recommended Utilization:

- 1) Livestock Grazing: This is possible in all of the zone except for a few spots of heavy fly and is compatible with wildlife utilization provided properly organized schemes to utilize the two forms of land use are integrated and firmly administered.
- 2) Hunting and viewing, photography, etc., by T.W.S. and local hunters, and with more effective utilization the hunting could be expanded. It is recommended that more of the revenue goes to the Range Commission/Council than at present.

- 3) People's Defence Force Area will be utilized for army purposes, and most of this could be utilized for hunting during much of the year. Revenue to go to Range Commission/Council.
- 4) Acacia tree cutting for charcoal to be prohibited because of the value of acacia to game and stock.

IV. Simanjiro Game Controlled Area

This is the largest of the controlled areas in Masailand. It is divided into three blocks.

- a) Relative Importance: This area provides the most popular hunting area for Masailand being easily accessible from the tourist centre at Arusha. The main game habitats are the vast Simanjiro Plains to the south of Lolkisale. Thousands of zebra and wildebeest from the Tarangire spend their wet season here. Other migrants to Simanjiro include buffalo, elephant (to Lolkisale mountain areas), oryx, eland (to Terrat and other areas), giraffe (to Ardaai and Messerani) and others which disperse into the whole of the controlled area. Presently yearly controlled area fees are 7,600/00, 75 percent of which goes to the Masai Council. Approximately 40,000/00 in game license fees are sold for tourists going to the area. This means foreign currency gain of about ₩ 15,000 to Tanzania. With proper management and control of grazing, etc., this could be boosted many times. Animals seen are elephant, rhino, oryx, eland, lesser kudu, zebra, kongoni, wildebeest, lion, antelopes, leopard, buffalo, etc.
- b) Recommended Utilization:
 - 1) Livestock Grazing: This area contained some of the best grazing habitat around Ardaai, Simanjiro and Makuyuni. At the moment livestock is almost entirely destructive.

Planned livestock management integrated with wildlife is the best land use in this Acacia-Commiphora Bush (Fallon Report). Livestock planning should bear in mind that wildlife and livestock profit in certain parts of Simanjiro Controlled Area would be more profitable than only livestock keeping and would be in better balance with the ecosystem, i.e., control of bush and scrub by game feeding.

- 2) Hunting by T.W.S.: As stated above it is already by virtue of its geographical position a most popular hunting area. More illegal killing control and improved livestock grazing methods must be introduced to improve takeoff. The first has been covered by an application to E.A.W.L. Society for an anti-poaching team grant, and the second can be tackled by the strict acceptance of Range Commission principles.
- 3) Game Cropping: The zebra and wildebeest on the Simanjiro Plains area should be cropped either by sale of fresh meat to Arusha or mobile cannery. About 1,000 animals could be cropped per year. Study on lines of Sachs and Glees necessary first. We are thereby utilizing the yearly increase from the Tarangire as well.
- 4) Honey Collection: This is widely practiced and could be expanded with Beekeeping Section's help.
- 5) Acacia tree destruction by charcoal cutters to be stopped at once. Alternative supplies are available from the Forestry Department Plantations.
- 6) Lekarau Bull Breeding Station: This boundary must be amended to remove its joint western boundary with the proposed Tarangire National Park. A reasonable ecological boundary must be worked out at least 7 miles from the Matete dry season concentration area within the Park boundaries. Provided the above is carried out with due regard to wise overall land use the station can be integrated within the viable land use proposals. Otherwise this is a most serious threat to a vast area.

Both for the breeding centre and wise range utilization the unauthorized cash crop squatters should be removed before they become entrenched and cause destruction to an area incapable in the long term of supporting this form of agriculture.

(1/3/67 - It is now proposed that the bull station be placed elsewhere. However, in the new siting the interests of wildlife should still be kept in mind.)

- 7) Tanzania People's Defence Force Training Ground: This area to be made a separate controlled area and parts utilized for hunting (T.W.S.) when not in use by T.P.D.F.

V. Ruvu-Kitwai-Handeni Game Controlled Areas

This section of the management plan will be expanded when progress has been made on the earlier mentioned areas. See List of Work Priorities:

a) Relative Importance: The Ruvu River was formerly a very important dry season habitat for all thorn bush-plains game communities. With soil and grass deterioration the original reserve was abandoned in 1951. The productivity of the area is now low.

Kitwai is a wet season habitat of zebra, wildebeest, etc. and includes the permanent Ruvu water.

Handeni Controlled Area is probably the most valuable of the three areas being both dry season and wet season habitat for all plains-thorn bush communities and owing to tsetse it is not in a bad state of vegetation deterioration.

Areas of importance are Talamai Hill, Saunyi River, Kitwai Mbuga System.

b) Recommended Utilization: Much depends on halting the land deterioration by cattle. Therefore the priority is:

- 1) Regulated range control for livestock.
- 2) T.W.S. hunting parties, etc., to hunt in the three controlled areas. This could be increased to 72 parties a year with improvement in the range condition. Local hunting allowed as at present.
- 3) Honey collection to be developed.
- 4) Acacia tree cutting for charcoal to be prohibited and the problem of grass burning to be investigated particularly in the hill ranges such as Talamai.
- 5) The tourist industry to investigate the attraction of the proto-historic well system and other archaeological remains in the Kitwai-Talamai area.

VI. Rest of South Masailand

- a) Relative Importance: 4,800 square miles of mixed bush and plains including the Mkame Depression. Not enough is known to state with certainty its relative importance but there is a wildlife population of similar density to Simanjiro. Kijungu and Kibaya areas are famous for elephant who rely on these areas for their dry season habitat.
- b) Recommended Utilization:
 - 1) Livestock grazing on planned management basis to replace the present destructive practices. Fallon's Report and Range Management Commission plans will it is hoped halt present destruction.
 - 2) The 4,800 square miles to be divided into three controlled hunting areas.
 - a) The west of Nabarera-Kibaya Road Controlled Area.
 - b) Makame Depression Controlled Area west of the Nabarera-Kibaya Road.
 - c) Kibaya Controlled Area. Masai District south of the Kondoa-Kijungu road.

T.W.S. and paying hunters would provide a potential 15,000/00 in permit fees for the Council and if some of the license fees was handed on a further 30,000/00.

VII Mkungunero Game Controlled Area

This area is included in the Masailand ecosystem but politically in Kondoa District.

- a) Relative Importance: This area is of great importance and should be added to the Tarangire proposed park to make it a more viable unit in size. It is not inhabited at present so this is possible. Mainly a wet season habitat for thorn bush communities including roan antelope. Tsetse (G. Moritans and Swynnerton) infested.
- b) Recommended Utilization: To be incorporated in proposed National Park.

VIII. Sanya Plains, Leltema Mountains Controlled Area

- a) Relative Importance: The Sanya Plains were one of the great wildlife concentration areas, but lack of planning and unwise water use have gone a long way to destroy this asset. Unless conservation methods are enforced destructive cash cropping will destroy this area north of the Kikuletwa. South of the Kikuletwa is an arid area of bush whose potential utilization is endangered by uncontrolled grazing. There is an abundance of bird life.
- b) Recommended Utilization:
 - 1) Livestock grazing on planned management lines.
 - 2) Local hunters and T.W.S.
 - 3) Moshi Gun Club have responsibility for conservation of wildlife in one section.

Areas North of the Moshi-Arusha-Dodoma Road

I. Mto-wa-Mbu Controlled Area

- a) Relative Importance: This area is still one of East Africa's finest wildlife areas and is rich in game. The areas east of Lake Manyara, around Mto-wa-Mbu and Kitete and Ngaruka are of principal importance. It is on a good road from the main tourist centre, Arusha, and in an area of outstanding scenic beauty below the great Rift Wall. The most popular hunting area in Tanzania for T.W.S. and poachers. All plains and bush species are found and a wildebeeste-zebra migration covers the western section.

Annually, wildlife populations, notably large herds of wildebeest, move from the Rift Valley area south and south-east of Lake Natron into some 50 square miles lying on the north-east shore of Lake Manyara, in order to reach the permanent water of the rivers which flow into the Lake. Lake Manyara National Park is stocked with game animals, many of which normally move into the Park from the north-east.

The whole population of the Eastern White-Bearded Wildebeeste (Connochaetus taurinus albojubatus) inhabiting north-eastern Tanzania and southern Kenya probably does not exceed 20,000 (as compared with the 400,000 of the western race) and is still declining. A large proportion of the total number of the eastern race, some 7,000 in number, has its dry season holding area in the immediate vicinity of the northern end of Lake Manyara. The area is absolutely essential to this population as the animals water in the rivers entering the northern end of the Lake.

It has become clear in recent years, since the Lake has been at its present high level, that the game population of the Park becomes gradually reduced owing to the reduction in the amount of land available to it. When the Lake level falls, animal numbers can only be built up again quickly through the movement of animals from the north-east shore of the Lake. The 40 square miles of land in question must, therefore, be regarded as essential to the National Park for the purpose of providing a reservoir for restocking the Park when the Lake recedes in the future. The buffalo population of the Park is not wholly resident within the present Park boundaries. Some 600 to 1,000 buffalo regularly move into the area on the north-east lake shore. This is a further reason why this small area should be included in the National Park.

The importance of the land on the north-east shore of Lake Manyara as a wildlife conservation area, as is indicated by the above points, cannot be over-estimated. Only some 60 square miles of country is involved, and this small area is of greater significance for the wildebeeste population and as a part of the ecosystem of the Manyara Park than several thousand square miles of the surrounding country of Masailand.

b) Recommended Utilization:

- 1) The section east and north east of Lake Manyara to be added to the Manyara Park or restrictive settlement rules to be imposed. This is a vital dry season retreat for much wildlife and needs protecting now.
- 2) Tourist, paying hunting and local hunting, perhaps making two blocks.
- 3) Livestock grazing on planned management lines.
- 4) Kitete Swamp to be given reserve status to preserve its vegetation.
- 5) Upper Kitete Game Corridor to be maintained and not cultivated.
- 6) A hunting lodge of modest size to be constructed under Masai Range Commission at Kitete to provide accommodation for small scale tourist hunters and others.
- 7) Game cropping.

II. Lake Natron Controlled Area

a) Relative Importance: This old original plains game-thorn bush reserve has been seriously damaged by vegetation destruction caused by bad stock keeping methods and ill-advised palliatives such as water points provided by Government. It still includes oryx, kongoni, zebra, gerenuk, elephant, lion, wildebeest, eland, etc. in good numbers during periods of the year, especially between Oldenyo Lengai and Kitumbeine where the plains game congregate in thousands during the December-January period of green grass.

Above all it has a unique scenic splendour unbeaten by Ngorongoro in its volcano and vast rift wall. The area is easily accessible on one side from the Nairobi tarmac road but roads within the area are 4-wheel drive only.

The mountain masses of Gelai and Kitumbeine are important water points and dry season refuges.

b) Recommended Utilization:

- 1) The first essential is to stop the habitat destruction by planned livestock grazing.
- 2) Preservation of the mountain catchment areas of Gelai and Kitumbeine by continuing Forest Reserve totally closed policy above a set altitude. No entrance to be allowed. Only this can assure the continuance of water supplies.
- 3) T.W.S. tourist and paying hunting.
- 4) Investigations into tourist potential in view of the scenic attractions given in the East African Standard article of 27/1/67.

III. Longido Controlled Area

a) Relative Importance: This is similar to Lake Natron Controlled Area plus its adjoining the Amboseli Reserve makes it important to restrict hunting on the border. The Longido Mountain provides water and a dry season refuge. The Ngaserai Furrow Area is of great value now the wildlife is denied access to the slopes of Kilimanjaro in the Ol Molog area. The area has some of the finest oryx and kudu in the world besides the normal thorn bush species.

b) Recommended Utilization:

- 1) The first essential is to stop the soil and habitat destruction by planned livestock grazing.
- 2) Preservation of the mountain forest water catchment area at Longido from fire and goat grazing destruction. This is to be totally closed to stock.
- 3) T.W.S. tourist and paying hunting.
- 4) Development of Moshi Gun Club. A royalty to be paid to Masai District Council.
- 5) Full utilization of the Masai Furrow by stopping illegal agriculturalists near source of furrow.
- 6) Protection for Amboseli by maintaining a five-mile no-hunting zone at territorial border.

IV. Loliondo Game Controlled Area

a) Relative Importance: Fifty miles of its south and west border is the Serengeti Park and 50 miles border the Ngorongoro Conservation Unit. None of this border can be said to be a habitat zone border. The ecological stability of the area is of vital importance to the Park and Ngorongoro because land destruction outside will inevitably produce demands for Park or Ngorongoro grazing.

It has supplied over the last 4 years about 3 percent of the resource requirements of the migratory plains game, which are of paramount importance in the ecology of the whole Serengeti region (about 12,000 square miles). This 3% is important and cannot be dismissed as a mere 3%. Consider the concern that TNP are (or should be) feeling over the 2.8% of total wildebeest range to the south of the corridor of the SNP. These figures are derived from aerial plots and are pretty accurate. The species noted here as migratory plains game are: wildebeest, zebra, Thomson's gazelle, and eland. They are in total number at this time close to 1,000,000 head.

Loliondo C.A. seems to be the permanent range of a population of more or less resident wildebeest, which may or may not be linked with the wildebeest of the Leita/Mara region. The population size is of the order 5-10,000. The dry season is spent in the highlands (and possibly some move onto the dry season range of the migrants in the Kuka area). The wet season is spent on the plains to the south and west of Loliondo. This population is made up of individuals that are easily distinguished from migratory wildebeest, and offer, from the scientific point of view, a most valuable source of comparative information.

Zebra, eland, and Thomson's gazelle likewise have quite large resident populations, although I have no information on the size.

A wide variety of other herbivores are commonly seen: impala, dikdik, oryx, steinbuck, warthog, giraffe, kongoni, a few topi, buffalo, elephant, rhino, etc. In addition the full spectrum of carnivora are present in good quantity.

The highlands areas offer some of the most spectacular views and landscapes, rivalling Ngorongoro. The view of Natron and the Ngorongoro Crater Highlands from the heights above Loliondo is really magnificent. The area is free from tsetse (or practically so), and has a wide range of accessible altitudes, enabling selection of climate. The meeting of the plains fauna and flora in the Loliondo region is more gradual, and allows closer examination, than the same affect at Ngorongoro.

Masai and Sonjo are picturesque, and the former do not constitute the menace to wildlife that other indigenes do. They still use their traditional land use practices, and if it were not for the vets (sic) they could be profitably allowed to continue doing so. //

Rainfall has a pronounced northward running gradient of increasing rainfall, from below 15" in the Sale to more than 50" in the highlands. Soils have much variety: there are juvenile volcanic dusts and dunes in the extreme southeast, more mature volcanic soils in the southwest, and various sedimentary soils in the north. The Loliondo highlands have a wide variety of soils in catenary formations.

This all adds up to variety, which is increasingly rare in biological systems throughout the world. The variety of biological phenomena in the Loliondo controlled area make tourism a most promising form of land use.

There is evidence that rinderpest has a focus in the Loliondo Controlled Area, from which it emerges from time to time.

Continued use of the Loliondo Controlled Area by purely pastoral (and conservative) people is unlikely to enable good arguments to be raised against the introduction of cultivation in the highlands (which is already underway). Therefore, without some planning, and some counter-proposals, agriculture of a primitive sort could envelope the highlands, and eliminate the dry season range of most of the herbivores of the controlled area. This would be serious to the whole Serengeti region because all the Grumeti/Sololedi river system has its source in the Loliondo highlands. In fact these highlands are far more important to the Serengeti, both in terms of river water and probably water table, than the Ngorongoro highlands. Water from Ngorongoro goes down to the rift valley floor water table (largely), whereas a considerable proportion of water falling on the Loliondo highlands drains into Lake Victoria by way of the semi-permanent rivers, and over the granitoid shield and Bukoban and Nyanzian rocks in a not too deep water table, which in part explains the value of the northern extension of the Serengeti National Park as dry season range. In short, cultivation of the Loliondo highlands might seriously interfere with the whole Serengeti ecosystem, apart from certainly ruining the Loliondo Controlled Area from the point of view of exploitation of the natural fauna and flora.

b) Suggested Utilization:

- 1) Tourism: Loliondo, or somewhere in the highlands offer a really magnificent setting. Small amounts of money would make the Ngorongoro-Loliondo-Mara part of the general Nairobi to Nairobi return circuit a very attractive alternative to the present route through Seronera. Seronera would also benefit by having another good tourist centre close by. I know this would be welcomed by tour operators, who are desperate for an alternative route back from the Manyara, Ngorongoro district.
- 2) Ranching of cattle and/or wild herbivores. One would make use of the juxtaposition of the very productive plains for wet season use with the highlands as dry season retreats, as is already by the Masai. However, a more effective although less spectacular approach would result from continuing to encourage the Masai to be productive, with vigorous application of range management principles to prevent overgrazing.

- 3) Cropping. Marketing is a major problem. Sachs has some good information on this topic. I feel that canned meat is the answer to cropping large mobile populations distant from human centres. No one has really developed the specialist market of canned meats. A small scheme taking biologically acceptable levels of all your edible species could develop into a valuable revenue earner if handled with drive. The numbers of animals could be very small, and a negligible price to pay for the conservation of the Loliondo Controlled Area. For instance, "Loliondo impala" in a tin might well fetch 20/- a pound in Harrods, which is the price of ivory in East Africa. Hides of lesser known species, if handled in a specialist market can likewise be very valuable. For instance, a carosse of 16 Thomson's gazelle skins could well be retailed in UK for £ 200. This all depends on the way the goods are handled and promoted.
- 4) Research. A form of land use as demonstrated by Tanzania National Parks (i.e., a source of revenue and a bolster to conservation) - good possibilities for research especially on disease (rinderpest and Malign Catarh).
- 5) Conservation of water catchment areas by Forest Reservation and establishment of plantations to provide posts for ranch fencing when required.
- 6) The total removal of Sero Kenya tribesmen to re-establish the dry season habitat in toto.

V. Other Areas

Yaeda Chini in Mbulu District to be investigated to protect the Watindiga livestock, i.e., wild animals. The Mangati (Barabaig) area centre on Basutu to be investigated to decide its most suitable land use.

Implementation of Plan - Schedule

Order of Importance

1. Acceptance and backing of government of plan.
2. Loliondo Ecological Survey and detailed plan. See Project Plan dated 8/6/66 enclosed.
3. Finalization of best and possible boundaries for Tarangire Reserve.
4. The declaration of all Masailand to be a controlled area, and it then to be divided into blocks similar to present areas but altered in the case of the TPDF area. The sole purpose of this change is for presentation or "sales" talk to the Commission to make it easier to appreciate the income side.
5. Development of canning work - pilot plants.
6. Masai Range Commission to either license or build and rent out lodges.
7. The other divisions of government to finalize suggestions on land use so that modifications can be made to the wildlife plan.
8. Production of more detailed management plan for each controlled area, park, reserve, et. al.

Estimated Returns From Managed Utilization
of Wildlife Massailand Controlled Areas

(Does not include present Parks or Ngorongoro)

	Controlled Area & Entrance Fees to Govt. 25%	License Fees to Government 25%	Controlled Area License Fee to District Council 75%	Foreign Exchange
1) Lolkissale Controlled Area. @ 400/- per permit. $\frac{1}{2}$ proceeds of 20 T.W.S. safaris.	4,000/-	15,000/-	57,000/-	300,000/-
2) Simanjiro Controlled Area. 3 Blocks @ 400/- per permit. $\frac{1}{2}$ proceeds of 40 T.W.S. safaris.	8,000/-	30,000/-	114,000/-	600,000/-
3) Ruvu Controlled Area. 2 Blocks @ 200/- per permit. $\frac{1}{2}$ proceeds of 20 T.W.S. safaris.	2,000/-	15,000/-	51,000/-	300,000/-
4) Kitwai & Handeni C.A.'s 2 Blocks. $\frac{1}{2}$ proceeds of 10 T.W.S. safaris. 200/- per permit.	1,000/-	7,500/-	22,500/-	150,000/-
5) Sanya Plains C.A.				
6) Mto-wa-Mbu Controlled Area @ 400/- . $\frac{1}{2}$ proceeds of 20 T.W.S. Safaris.	4,000/-	15,000/-	57,000/-	300,000/-

	Controlled Area & Entrance Fees to Govt.	License Fees to Government	Controlled Area License Fees 75% District Council	Foreign License Fee to Exchange
7) Lake Natron C.A. @ 300/-. ½ proceeds of 10 T.W.S. Safaris.	1,500/-	7,500/-	27,000/-	150,000/-
8) Longido C.A. @ 300/-. proceeds of 10 T.W.S. Safaris.	1,500/-	7,500/-	27,000/-	150,000/-
9) Loliondo C.A. @ 300/-. proceeds of 10 T.W.S. Safaris.	1,500/-	7,500/-	27,000/-	150,000/-
10) Ngorongoro @ 400/- . Assum- ing 5 T.W.S. safaris or equivalent. ½ proceeds.	1,000/-	3,750/-	6,250/-	37,500/-
11) Residents 30 permits @ 50/- & 10 @ 400/-.	1,620/-	---	4,860/-	---
12) Animal & Bird Catching				
13) Film Making Fees		10,000/-		
Total 75 T.W.S. Safaris	26,120/-	223,070/-	393,610/-	2,137,500/-
Estimated Returns for the Areas in 1966				
Controlled Area Fees	License Fees	Foreign Currency	Fees to Masai Council	75% of C.A.
All Masailand Controlled Areas	22,800/- in 7 months. Approx. for year 39,072/-	57 parties at 2 persons per party @ 3,000/- per person.	1,710,000/- Average party spends 1,500 242,000/-	29,310/-

Comments - SuggestionsA. Earth dams

It is good practice to incorporate features in the earth dam design which reduce future maintenance costs. Some have been discussed in the report such as reducing rate of discharge of flood flows through the spillways, the minimizing of sedimentation and control of seepage. Others are:

1. Grassing of the earth dam slopes above the water line immediately after construction to prevent erosion; and requirement of mowing to reduce rodent damage.
2. Fencing the dam and reservoir to allow use of watering troughs only.
3. Prohibiting growth of trees and brush on the dam to avoid possibility of piping.
4. Providing a grassed filter band around the reservoir of sufficient width to cause deposition of silt being carried by run-off entering the reservoir.
5. Deepening the reservoir edges to reduce mosquito breeding conditions. In the deepwater reservoirs, stocking with fish provides a source of food and helps reduce the mosquito problem.

B. Springs - Pipe lines

1. The problem of silt and trash clogging at the intake box can be minimized by constructing a permeable barrier upstream and by deepening the catch basin at the box to allow deposition of silt.
2. Weirs, such as at the Mfereji intake, should have the earth wing walls extended to prevent any of the stream flows being diverted away from the intake box.

C. Charcos

Graded sand-gravel filter cones placed around each of the perforated pipes leading water into the reservoir and into the drawoff pipe would help reduce clogging.

APPENDIX V

Analysis of the records of rainfall at six stations in the general region showed 3 distinct drought periods 1940-41, 1960-61, and 1964-65. The records at 2 stations covered a period of 37 years; 2 stations - 12 years; one station - 10 years; and one station - 8 years.

Drought Periods

Rainfall deficiency from Average
(millimeters)

<u>Gauge</u>	<u>May '40 - Oct '41</u>	<u>May '60 - Sept '61</u>	<u>May '64 - Feb '66</u>	<u>Variable</u>
Selian estate	360	570	535	22 months
Olmotonyi Forest estate	470	420	608	19 months
Tarosero estates		494	317	" "
Monduli Juu		351	578	20 "
Loiborsoit		230	463	19 "

Millimeters

<u>J</u>	<u>F</u>	<u>M</u>	<u>A</u>	<u>M</u>	<u>J</u>	<u>J</u>	<u>A</u>	<u>S</u>	<u>O</u>	<u>N</u>	<u>D</u>	<u>TOTAL</u>
172	157	163	134	129	117	120	132	151	166	145	154	1740

Applying these rates to respective drought periods gives totals as follows:

		<u>mm</u>
May '40 - Oct '41	(18 months)	2555
May '60 - Sep '61	(17 ")	2389
May '64 - Nov '65	(19 ")	2700
May '64 - Dec '65	(20 ")	2854
May '64 - Feb '66	(22 ")	3183

Surface Water Reservoirs
Evaporation minus Rainfall

Selian	<u>May '40 - Oct '41</u> 2555-731 = 1824 mm	<u>May '60 - Sept '61</u> 2389-503 = 1886 mm	<u>May '64 - Feb '66</u> 3183-873 = 2310 mm
Olmotonyi	<u>May '40 - Oct '41</u> 2555-691 = 1864 mm	<u>May '64 - Sept '61</u> 2389-713 = 1676 mm	<u>May '64 - Nov '65</u> 2700-672 = 2028 mm
Tarosero		<u>May '60 - Sept '61</u> 2389-536 = 1853 mm	<u>May '64 - Nov '65</u> 2700-867 = 1833 mm
Monduli		<u>May '60 - Sept '61</u> 2389-597 = 1792 mm	<u>May '64 - Dec '65</u> 2854-636 = 2218 mm
Loiborsoit		<u>May '60 - Sept '61</u> 2389-476 = 1913 mm	<u>May '64 - Nov '65</u> 2700-323 = 2377 mm

KENYAThe Maintenance of Mechanical Equipment
on Boreholes and Pumping StationsA Maintenance Plan for 16 Group Ranches

Systematic and regular maintenance of all mechanical equipment is necessary throughout its life period. Haphazard maintenance, confined to the repair of breakdowns only, inevitably leads to the plant being out of commission at times when it is required most, during long dry spells when both livestock and humans are entirely dependent on groundwater for subsistence.

The water development proposals for the 16 Group Ranches include a maximum of 28 boreholes and one surface pumping station from the Simba Springs. Six of the boreholes include secondary pumping equipment to boost the water through pipelines to distant water points.

The value of the fixed and movable assets connected with the production of groundwater is estimated to be £ 78,606 and for the collection and storage of surface water £ 14,608. These values should always be maintained by correct depreciation over their life period, and the life period depends entirely on regular maintenance.

The present system of maintenance of existing boreholes is funded by a cess collected by the Kajiado County Council from herd owners and is reputed to be 50 cents per head of livestock per month or Shs. 6/- per annum. As this cess also covers the operation; i.e., the provision of fuel and oil and the payment of the wages of the borehole operator, the element left for maintenance and repairs would only be inadequate in areas where the borehole was badly sited or the numbers of livestock insufficient to make full use of the water available. The maintenance of all water installations in the Kajiado District is carried out by a unit employed by the Kajiado County Council and based at Kajiado.

The division of part of the Kaputici area into 16 self-contained and self-financed ranch units has necessitated the segregation of the operation and maintenance factors. The responsibility for the operation of each water supply unit within a ranch boundary will rest entirely with

the inhabitants of that particular ranch. The maintenance of these water supply units, however, will have to continue to be done by a maintenance gang based preferably at Kajiado. Whether this maintenance gang is controlled by the County Council or by the Government's Water Development Department is a matter for policy decision. However, it would be preferable, due to possible finance complications where contributions will be made by each Group Ranch within this scheme while in respect of water installations outside the scheme the livestock will continue, if the Water Development Department were to control the maintenance of the water supply installations within the 16 Group Ranches. This should be the case at least in the initial stages or until the remainder of the installations within the Kajiado District could be brought onto a similar financial footing.

The maintenance plan envisaged requires a contribution from each group ranch, in respect of each borehole or pumping station, of the sum of £ 84 annually where the water is used on site, and the sum of £ 109 annually where secondary booster pumping is involved. The total sum to be contributed by the 16 Group Ranches amounts to £ 2,591, and to ensure the success of the scheme this sum must be paid to the body controlling the maintenance unit at the commencement of each financial year. This sum will cover one major overhaul and two minor overhauls for each installation per year. The major overhauls will consist of complete stripping of the engine, replacement of any worn or damaged parts with particular reference to bearings, valves and valve guides, and the replacement of oil and fuel filter elements. The well-head should be checked, but not stripped unless the replacement of worn parts demands this. The wellrods, drop pipe, and cylinder should be withdrawn and examined for wear or corrosion. If a booster pump is involved this should also be checked thoroughly. If a water cooled engine is used, particular attention must be given to the engine water jacket by cleaning out calcinareous deposits. This is particularly important where rain water is not available and the cooling system is filled from borehole water. The major overhauls should be done systematically on one round trip, preferably during the rainy season from mid-February to the end of April. This period allows two and one-half days to be spent at each installation.

The motor overhauls are routine checks but, as they will occur at 900 to 1,000 running hour intervals, should preferably include decarbonizing of the cylinder head and checking valve seats, cleaning of the fuel and oil filter elements (if not of the paper type) when they should be renewed, and the normal replacement of worn pump leathers. The governor controls should also be checked to ensure that the engine is running at its correct speed. The engine and pump oil changes at 500-hour intervals

will normally be done by the operator without reference to the maintenance unit. The minor overhauls should take place, again on the round-trip basis, between the 1st of July and the middle of August, and between the middle of October and the end of November. This will spread the intervals to periods when maximum use is not being made of the installations and thus no hardship or inconvenience will be imposed on livestock or inhabitants.

It is envisaged that the maintenance unit will consist of one artisan and five semi-skilled laborers, this being the minimum number that can, with safety, withdraw a deep well installation with a hand winch. The time factor for the major and minor overhauls allows for full employment for this unit for eight months of the year so that four months could be utilized on work outside the scheme. The cost of this unit in actual salaries will amount to £ 720 but with overtime and allowances may be nearer £ 800. The transport costs for three round trips of 300 miles each plus an allowance of 50 percent for extra running; i.e., 1,350 miles at Shs. 4/50 per mile, could be £ 304. This leaves a sum of just over £ 50 per installation to cover the cost of spares and any overhead charges that may be levied by the controlling body. As 14 of the 28 boreholes will be new installations, some savings should be effected in the provision for spares in the first year or two which could be used for implementing stocks of the faster moving spares items, and also for the provision of airlines to existing boreholes.

It is essential that a certain number of statistical records be maintained at each pumping installation. Daily records should show the times of starting and stopping the pump and the hours run, the quantities of fuel and oil added, and notes of whether the oil included oil changes and whether any repairs were effected during that day. Weekly records should show the water rest level immediately before starting the pump and the maximum drawdown obtained immediately before stopping the pump, with a note of the hours run between the two measurements. The installation of an airline at each borehole is to enable these records to be obtained. During the rainy periods when the pump is not working, a daily record of the water rest level in the borehole should be obtained. It would be helpful if duplicate copies of all borehole water level measurements, together with any copies of rainfall data obtained at the ranch headquarters, could be sent to the Hydro-Geologist of the Water Development Department for his records.

Mention has not been made of the maintenance of water conservation and storage structures such as dams and tanks on the 5 ranches involved. As the earth structures are to be fenced to prevent trampling by cattle and game it is anticipated that maintenance can quite well be done by ranch staff with the help of a small tractor reequipped with a dozer blade for de-silting where required. De-silting can only be done at the end of a dry period when the dam is empty or low. Repairs, by revetting, of any erosion damage to the spillways must be done by hand labor, as well as repair of any erosion runnels on the dam embankment. These repairs should be done as soon as they are noticed and it should be the responsibility of the Officer-in-Charge or the Headman of each ranch to see that they are completed well before the onset of the rainy season.

APPENDIX VII

PROPOSED SITES OF PERMANENT CRUSHES
IN MASAI DISTRICT *

1. Olempout Nabe in Ngerengere Division
2. Keekpusi in Ngorongere Division
3. Ngong Onguishu-Longido Division
4. Nkairishi - in Ngorongoro Division
5. Olkine - in South Masai
6. Nguserekule - in South Masai

Loliondo Division

1. Monik	14. Wasse	27. Olipiri
2. Peninj	15. Loliondo	28. Ngoyowasse
3. Kirerei	16. Nguseru Sambu	29. Oljoroiber
4. Malambe	17. Olmotio	30. Lomoru
5. Sanjan	18. Masilik	31. Losoito
6. Sale	19. Sukenya	32. Arash
7. Masuswa	20. Mondorosi	33. Oldenye Narek
8. Dige Dige	21. Endulele	34. Kiletai
9. Saamunge	22. Okoleokwen	35. Piaya
10. Malene	23. Olsirwa	36. Serengetuni
11. Oldoinye Wasse	24. Olkerei	37. Olalaa
12. Lerire	25. Kirtale	38. Koka)-Portable
13. Lorien	26. Englerette	Olposi Meru)

Loliondo Division

1. Ngong Ongishu	9. Namanga	17. Kisseriani
2. Magadini	10. Kimekewa	18. Kikaret
3. Ngare Naiber	11. Longido	19. Sinya
4. Oldenye	12. Olmolog	20. Tinga Tinga
5. Matale	13. Kitenden	21. Oldenye Lengai
6. Gelai Lubwa	14. Ngarenanyuki	22. Oldonye Ngeri
7. Kitumbeine	15. Nunderara	23. Gelai Bomba
8. Lessingita	16. Muriatata	24. Kiseryan

* Source of Information - Veterinary Division Office - Monduli.

South Masai

1. Makuyuni	13. Naberera	25. Sikuru
2. Ngaruka	14. Olnira	26. Terat
3. Ndorken	15. Ngasumet	27. Maitu wa Tembe
4. Kitete	16. Lebeisserit	28. Oljerengine
5. Mte wa Mbu	17. Marakau	29. Shambarai
6. Kwa-Kuchinja	18. Lendanai	30. Oljoro Olgeneri
7. Mfereji	19. Namalulu	31. Kibaya
8. Mguu wa Zuberi	20. Seren	32. Ndede
9. Mesarani	21. Olmoti	33. Olkine
10. Mbuyuni	22. Obelesio	34. Kijungu
11. Lesirwa	23. Silali	35. Sunya
12. Ruvu Remiti	24. Leihererrit	36. Nguserekule

Ngorengoro Division

1. Olempeut Nabe	5. Olbalbal	9. Kimema
2. Munge	6. Endulen	10. Olpiro
3. Keek Pusi	7. Kakesie	11.)-Two more will
4. Ngerengere	8. Nkaitush	12.)-be built, sites undecid- ed.

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Maps

"ERRATA" MAP FIGURE B

Mfereji pipe line tanks should be numbered at locations as follows:

Tank number	Coordinates
1	218.4 - 9647.5
2	220.2 - 9652.8
3	214.8 - 9653.2
4	216.3 - 9659.1
5	213.3 - 9658.2
6	213.4 - 9663.7
7 (proposed)	223.0 - 9648.0

The pipe line from the proposed new tank #7 shown as J3 on the map, should be extended with a dashed red line, from the point at coordinates 222.0 - 9648.3 to the point at coordinates 220.0 - 9645.6

MARKET ROUTES AND PROPOSED ASSOCIATION AREAS

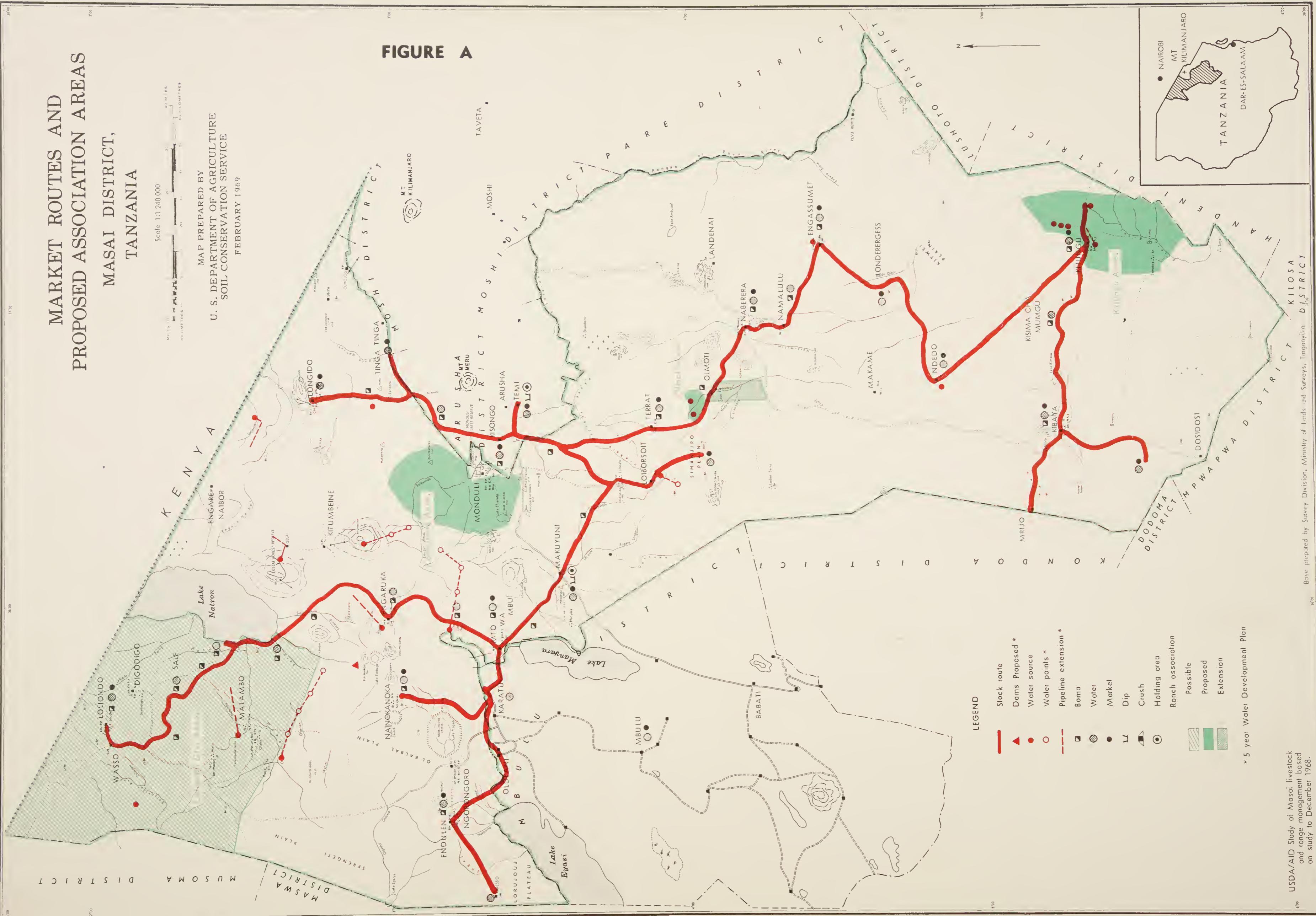
MASAI DISTRICT, TANZANIA

Scale 1:1240000

MILES 0 1 2 3 4 5
KILOMETERS 0 5 10 15 20 25

MAP PREPARED BY
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
FEBRUARY 1969

FIGURE A



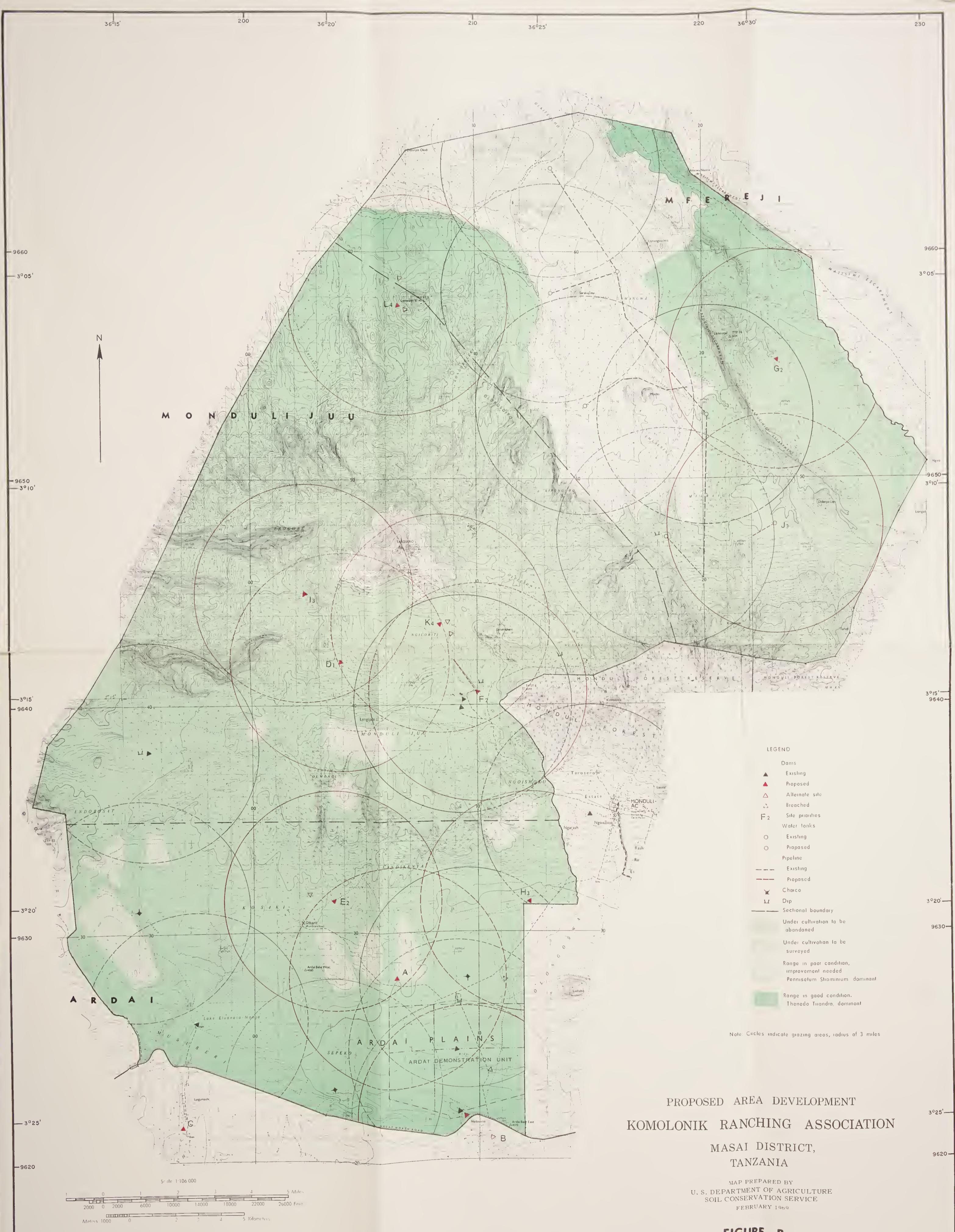


FIGURE B

USDA/AID Study of Masai Livestock
and Range Management based
on study to December 1968. 36

MAP PREPARED BY
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
FEBRUARY 1969

FIGURE 1

Base prepared by Survey Division, Ministry of Lands and Surveys, Tonganyiko
36°30' 230

PROPOSED RANCHING ASSOCIATION

KIJUNGU

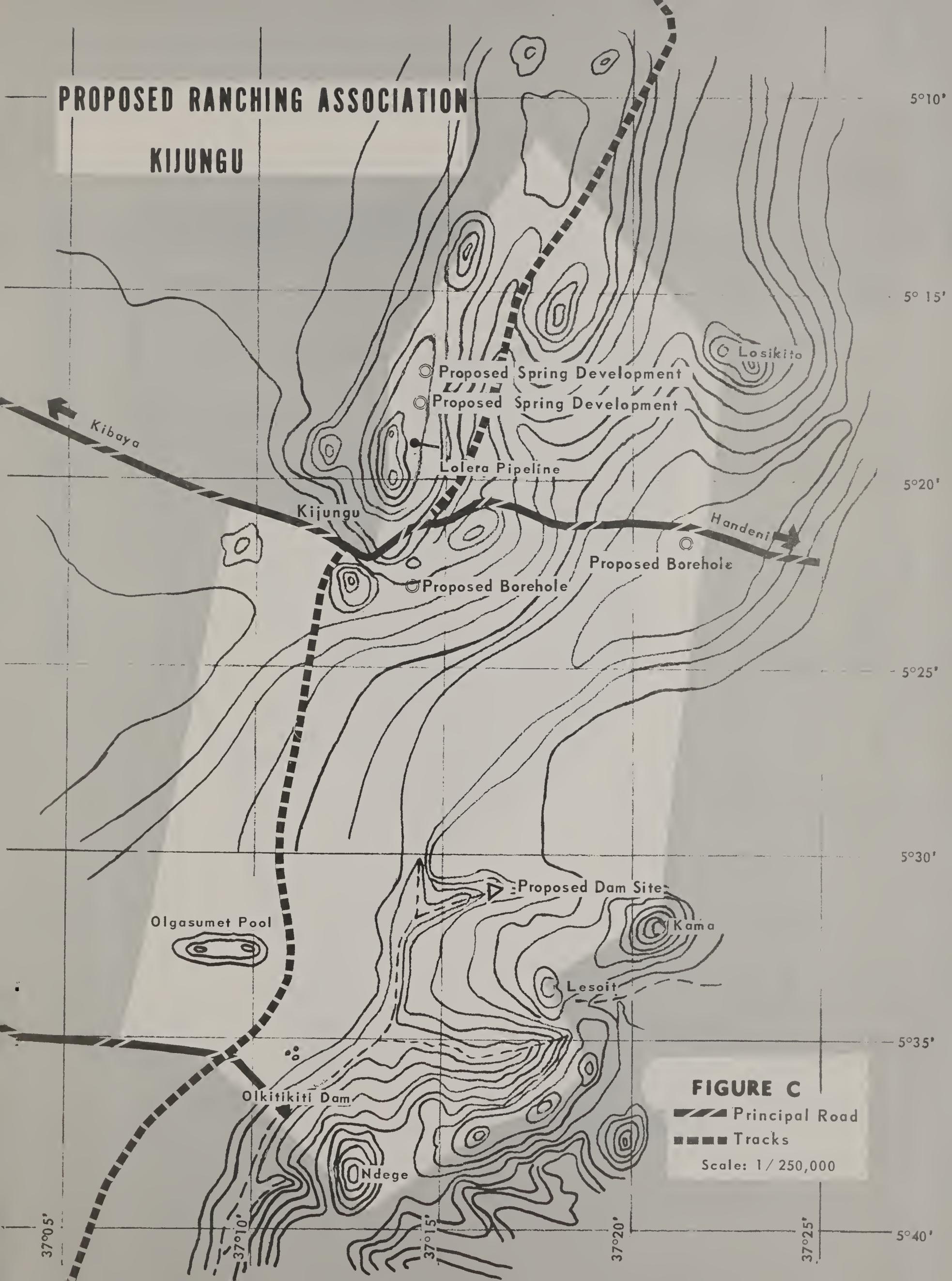


FIGURE C

Principal Road

Tracks

Scale: 1 / 250,000

PROPOSED RANCHING ASSOCIATION-OLMOTI

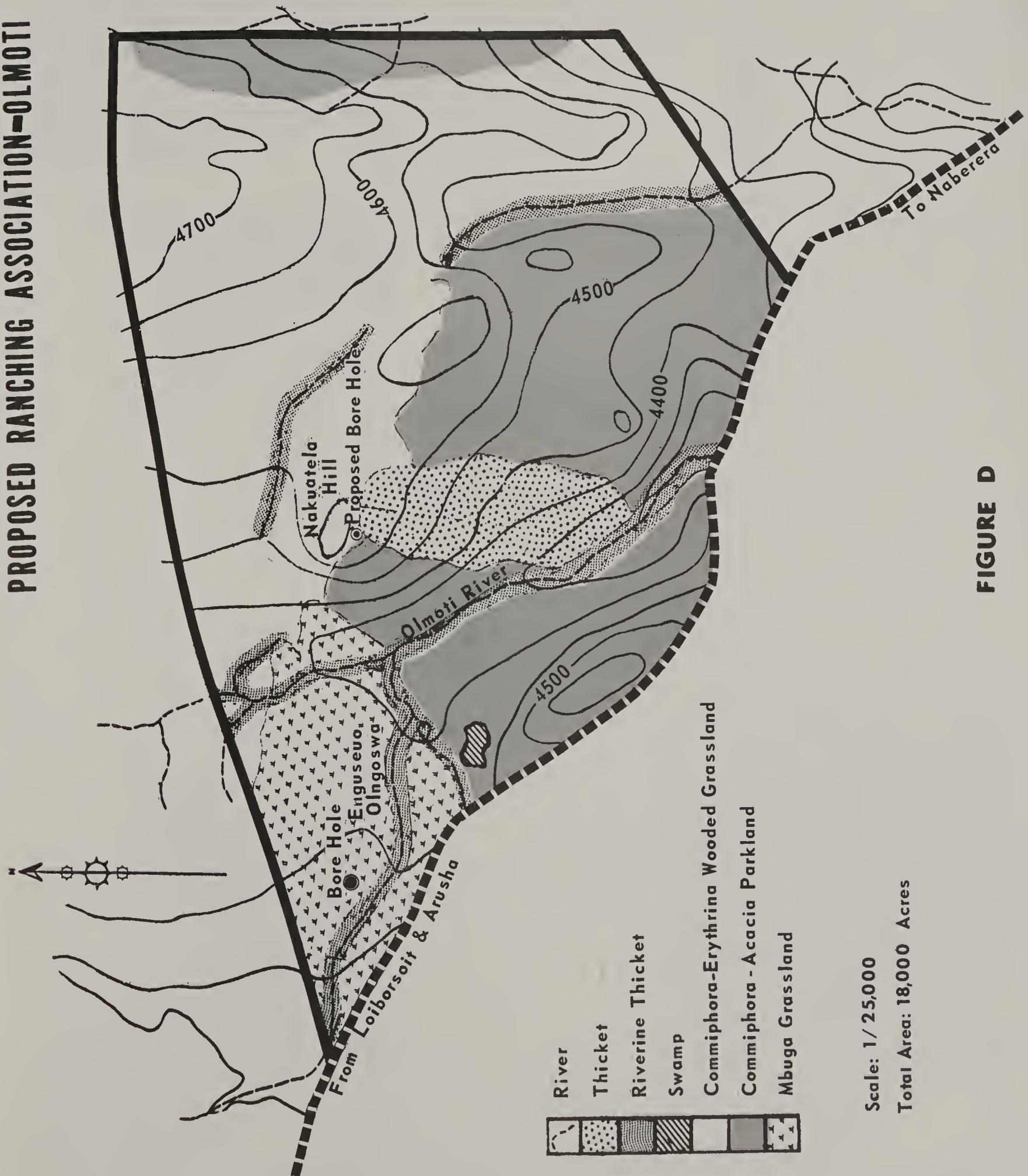


FIGURE D

Proposed Ranching Association Loliondo

